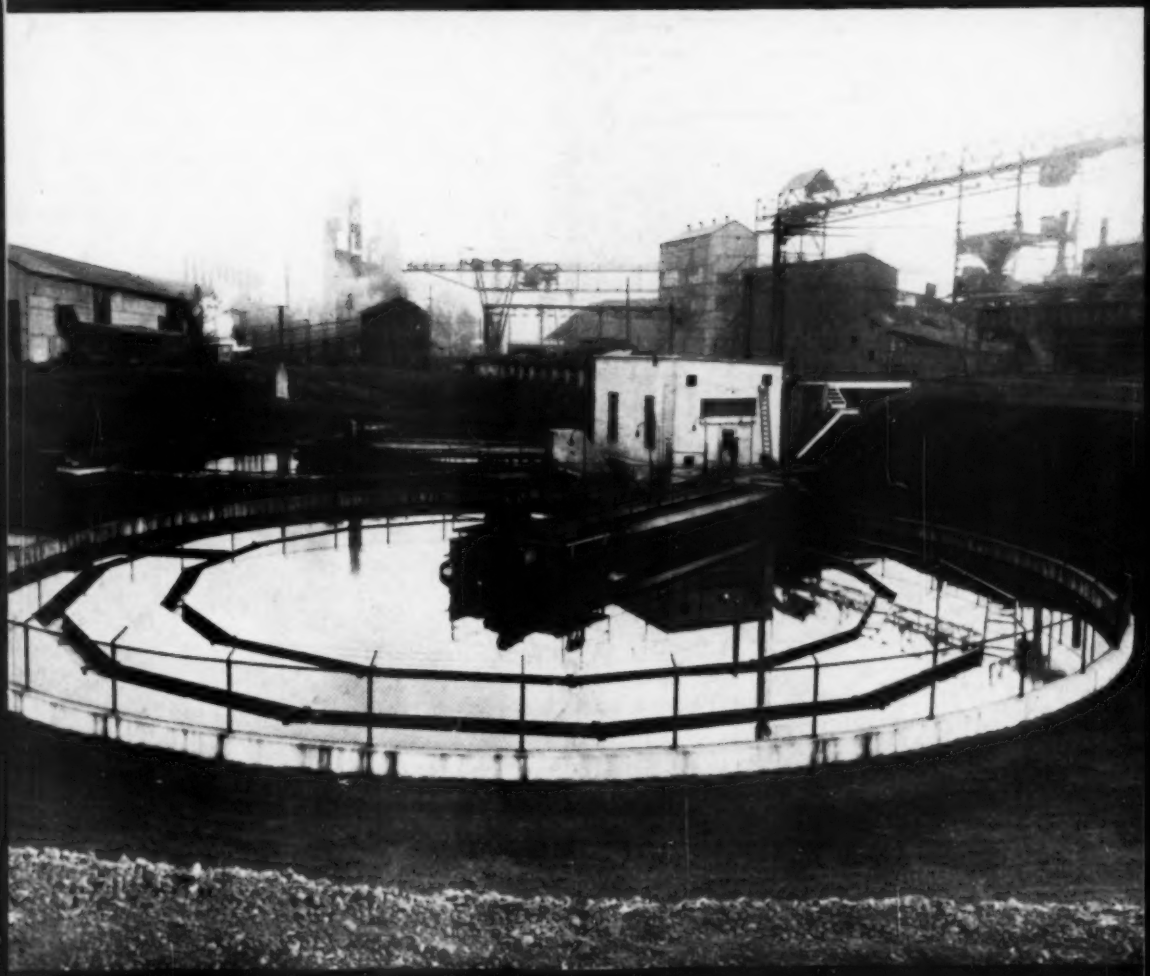
WATER & SEWAGE WORKS

WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL



FEBRUARY, 1952 — Waste Treatment Plant of J&L Steel Co.

"Million Dollar Gate" and then some!

WELL-MANAGED operations all over the country have invested millions of dollars in Chapman Standard Sluice Gates . . . and have received a substantial return in the savings effected by easy installation, low maintenance and dependable service.

Installation is expedited because interchangeable couplings don't have to be match-marked. In fact, the entire mechanism is made so that repair and replacement parts fit into place precisely, with no "file-and-fit" needed on the job.

And Chapman Standard Sluice Gates can be specified with the type of operating control best suited to the job . . . manual, hydraulic cylinder, or motor-operated floorstands. Get the full facts from Chapman's Standard Sluice Gate Bulletin 25 . . . send for your copy now.

The Chapman Valve Mfg. Co., Indian Orchard, Mass.

Chapman *Standard* Sluice Gates

INTRODUCING..

THE NEW WALLACE & TIERNAN FLUORIDATOR

Series A-635 *

design features

- Either Volumetric or Loss-of-Weight Control
- Loss-of-Weight Recording (optional)
- Dust-tight Construction
- Special Two-directional Feed Screw
- Large Dissolving Chamber
- Modern Streamlined Appearance
- Wide Feed Range

Special requirements of Fluoridation — primarily, extreme accuracy and dependability — were considered foremost in the design of W&T's new Series A-635 Fluoridator. A selection of models and a wide feed range make this feeder suitable for the application of sodium fluoride or sodium silicofluoride in most communities.

The basic feeder is volumetric with manual control, featuring the new two-directional feed screw for increased accuracy. Built-in scales can be supplied for periodic checking of the weight of chemical in the hopper.

The gravimetric, loss-of-weight, model is controlled from a unique scale beam housed in a dust-tight compartment. Registers indicate the rate of feed and the weight of chemical in the hopper at all times. Loss-of-weight recording is available with the gravimetric feeder to provide a permanent record of fluoridation.

WALLACE & TIERNAN COMPANY, INC.

CHLORINE AND CHEMICAL CONTROL EQUIPMENT

S-67

You can't beat

SANITATION HTH

for these 4 important uses...

CONTINUOUS CHLORINATION

STERILIZATION OF NEW MAINS

ALGAE CONTROL IN RESERVOIRS, ETC.

EMERGENCY CHLORINATION

In every water supply system, large or small, Sanitation HTH is a proven agent for maintaining safe water conditions. It is an easy-to-use, safe source of chlorine for regular water treatment. It makes an effective solution for the sterilization of new mains, pumps, standpipes and other supply equipment. It is widely used for algae control and for sterilization of reservoirs, basins, tanks, wells and flumes. And of vital importance, HTH should be on hand at all times for emergency chlorination in case of abnormal demands on the water supply system caused by drought, fire, flood, power failure, etc.

Wherever chlorination is needed, you can depend on Sanitation HTH. Dry, free-flowing and granular, Sanitation HTH is safe and easy to store and apply. Get complete information on *all 4 important uses* and dosage recommendations in the booklet, "Hypochlorination of Water." Write for your copy today. Mathieson Chemical Corporation, Baltimore 3, Maryland.

Sanitation HTH is available in cases of nine handy 5-lb. cans and in 100-lb. drums.

Mathieson
CHEMICALS

SERVING INDUSTRY, AGRICULTURE AND PUBLIC HEALTH

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WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT

COMING ARTICLES

Income and Outgo in Small Waterworks Operation . . . . . A. E. Clark
Metering, Tests and Records in Sewage Treatment . . . . . G. A. Reipe
What to Do and What Not to Do When Floods Hit . . . . . M. P. Hatcher
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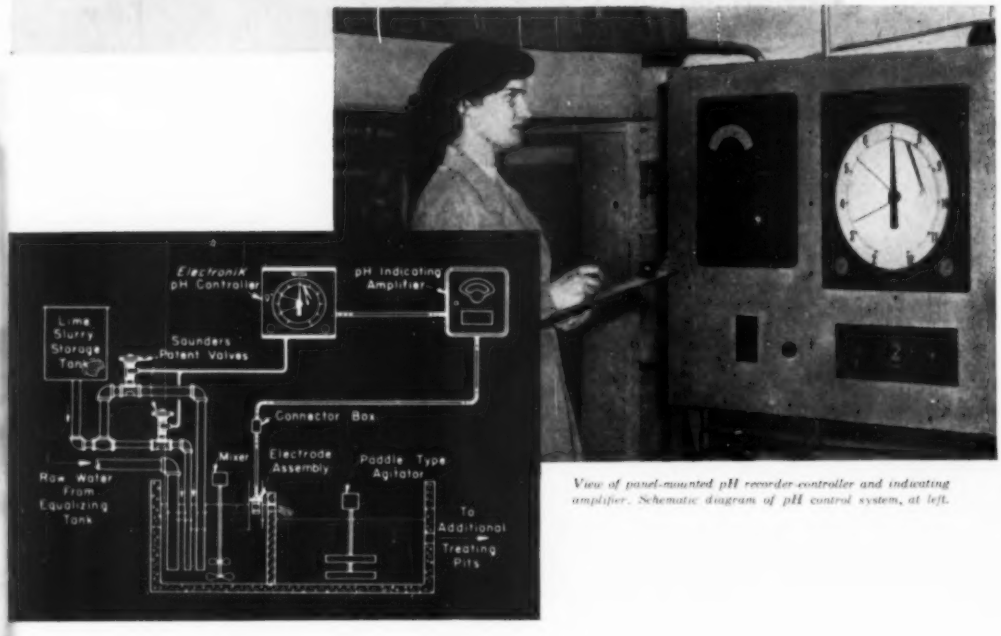
Precise pH Control

...regardless of process fluctuations



View of panel-mounted pH recorder-controller and indicating amplifier. Schematic diagram of pH control system, at left.

THE extreme sensitivity and high accuracy of the *ElectroniK* potentiometer combined with the reliability of the Beckman electrode and amplifier are ideally suited to pH measurement and control in waste treatment applications. Because *neither flow nor pH of waste liquor is constant*, this combination is especially valuable in that it provides proportional-plus-reset control for the variables. The resulting precise control maintains the pH of the treated liquor at the proper value regardless of unavoidable process fluctuations.

Constant pH value is important, of course, in that it permits minimum retention time and size of equipment . . . prevents excessive use of treating agent through accurate proportioning in accordance with requirements . . . and insures compliance with stream pollution regulations.

Our local engineering representative will welcome the opportunity to discuss your needs . . . he is as near as your phone.

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MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

● *Important Reference Data*

Write, today, for a copy of new Catalog No. 15-16

New York's City Hall, completed in 1811, as it looked 100 years ago

The City of New York has several cast iron water mains in service that were laid more than a century ago. They are part of approximately 5,000 miles of cast iron mains representing about 98% of all the pipe in New York's distribution system. The contrast in traffic and construction, above and underground, today and 100 years ago, is fantastic. Yet the shock-strength, crushing-strength and beam-strength of cast iron mains have enabled them to withstand the unforeseen stresses imposed by vast changes. Because of these strength factors and effective resistance to corrosion, cast iron water and gas mains laid over 100 years ago, are still serving in the streets of 38 cities in the United States and Canada.

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cast iron
PIPE
FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE

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PROGRESS REPORT

Philadelphia's Campaign for CLEAN WATERS

New 125,000,000 gallon-per-day Northeast Sewage Treatment Works, built to free Delaware River of pollution, utilizes over 100 G-E equipments

Over the years, almost 85 per cent of Philadelphia's sewage, currently estimated at 350 million gallons per day, has been poured untreated into the nearby Delaware and Schuylkill Rivers. Public and official displeasure with the resulting stream pollution led in 1945 to the adoption of a program for the completion of the sewage treatment system to serve the entire city area.

The first of three plants in the $60 million system, which is scheduled for completion in 1953, was placed in operation in April of this year. Designed for the future to serve the area's estimated 1970 population, the Northeast Sewage Treatment Works will abate pollution of the upper Delaware River.

G-E equipment in the new plant includes unit substations, switchgear and control, and over 75 drive motors. A less obvious but most important contribution to the effectiveness of the works has been G-E Application Engineering: fitting power-distribution and drive equipment to the job requirements.

General Electric helps make your pollution-control program a success in two ways:

1. Aids in winning public support through the G-E packaged program "Modern Sewage Treatment" including the full-color sound movie *Clean Waters*.
2. Assists your engineers or consultants in the formation of electrical plans.

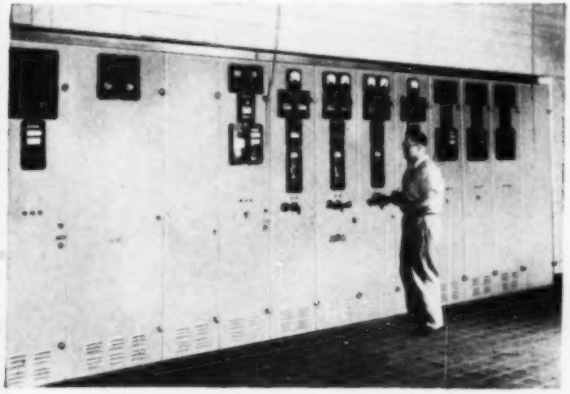
To take full advantage of these services, be sure to contact your G-E representative early in the planning stage. *General Electric Company, Schenectady 5, N. Y.*

Forty-eight G-E ½-hp induction motors power the sludge collector mechanisms in these final settling tanks. G-E 1-hp motors perform a similar function in the primary tanks.

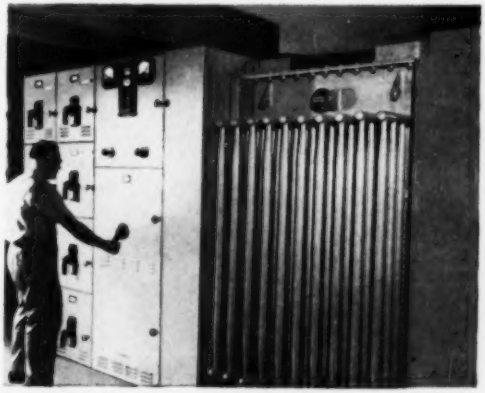
Three G-E Tri-Clad* 5-hp motors in foreground drive pumps which transfer sludge from primary tanks to heaters. In background, two G-E 7½-hp motors drive pumps which move warm sludge to digestor tanks after heating.

*Reg. Trade mark of General Electric Company

Northeast Sewage Treatment Works operates on the modified-activated-sludge process. Completion of Southeast and Southwest plants, will bring under treatment all sewage and industrial waste entering sewers in the Philadelphia area.



G-E metalclad switchgear controls 2300-volt power to three large motors which drive blowers supplying compressed air for the aeration tanks.



This G-E 500-kva, two-phase, 2400/240-volt unit substation is one of two in the blower house which supply power to sludge-pump and collector-mechanism drives.

GENERAL ELECTRIC

New well was surged at intervals for 48 hours with Calgon. Process increased well capacity from 15.3 to 25 gallons per minute per foot of draw down. With high standing water levels of 3', the upright pipe was used to increase the head available for surging.

How Warner Vaughan Company greatly increased water capacity of a new well with Calgon®

Treating new wells to increase initial capacity is an old story to Calgon. After the well drillers had completed the drilling of a new well for the City of Salisbury, Maryland, the Warner Vaughan Company engineers found the initial specific capacity of Well Number 9 to be 15.3 gallons per minute per foot of draw down. By arrangement with Philip Cooper, City Engineer, the new well was developed with Calgon, and specific capacity was increased to 25. Other new wells in the field developed specific capacity increases varying from none to 34%.

Warner Vaughan Company of Philadelphia has also successfully used Calgon treatment on a number of old wells in the same area to increase the capacity of wells which have fallen off substantially in production.

If you are interested in increasing the initial capacity of new wells or developing more capacity in old wells, we will be glad to discuss your specific problem with you.

Calgon was dissolved in a 55-gallon drum for use in surging process.

HAGAN HALL BUROMIN CALGON

calgon, inc.

A SUBSIDIARY OF HAGAN CORPORATION

HAGAN BUILDING PITTSBURGH 30, PA.

MUELLER

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Superior

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- PERMANENTLY ALIGNED DISCS: Discs can't spring out of shape. Wedging pressure applied at outer edges for perfect seal.
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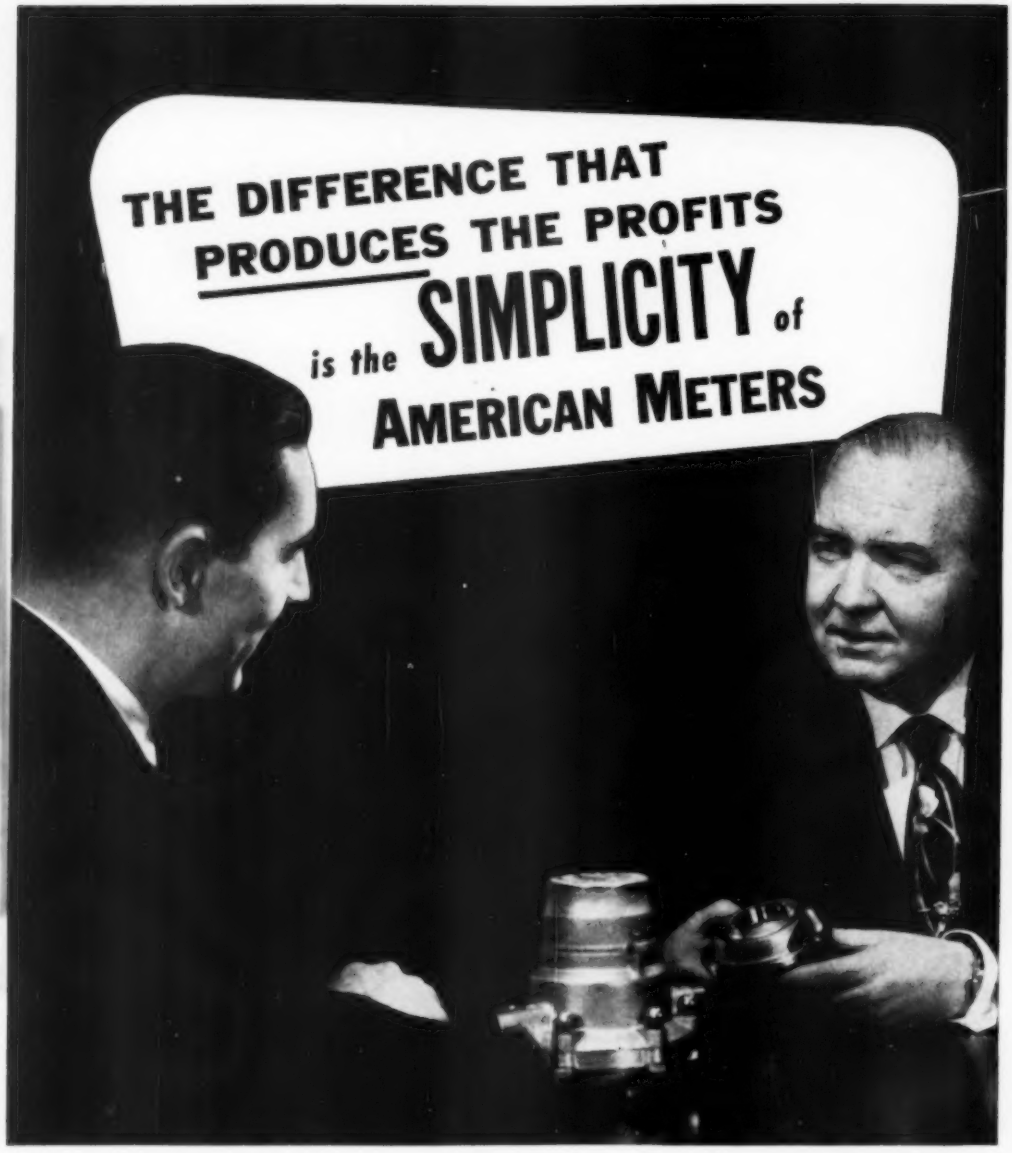
MUELLER CO. manufactures a wide variety of equipment especially designed for the Water Works Industry. This includes a full line of distribution equipment and specialties. Nearly a century of experience has proved that you can depend on any product that bears the Mueller name. Contact your Mueller representative, or write direct.

MUELLER CO.

Dependable Since 1857

CHATTANOOGA, TENNESSEE



● Most makes of Water Meters look similar, are made of the same materials, are priced competitively and are claimed to provide the same accuracy. What, then, are the differences? What values are outstanding?

American Meters stand out as the most exceptional value because of simplicity of design—fewer parts, simpler castings. This simplicity provides long life, quick easy repair. Only a small stock of interchangeable parts are needed to keep these meters producing. These benefits mean low cost efficient operation of the water department.

Ask for complete data.

BUFFALO METER CO.

2909 MAIN STREET, BUFFALO 14, NEW YORK

19,000,000 gpd 12# pressure
1° curve

AND "NO LEAKS"

with
TYLOX
flexible-rubber
JOINTS

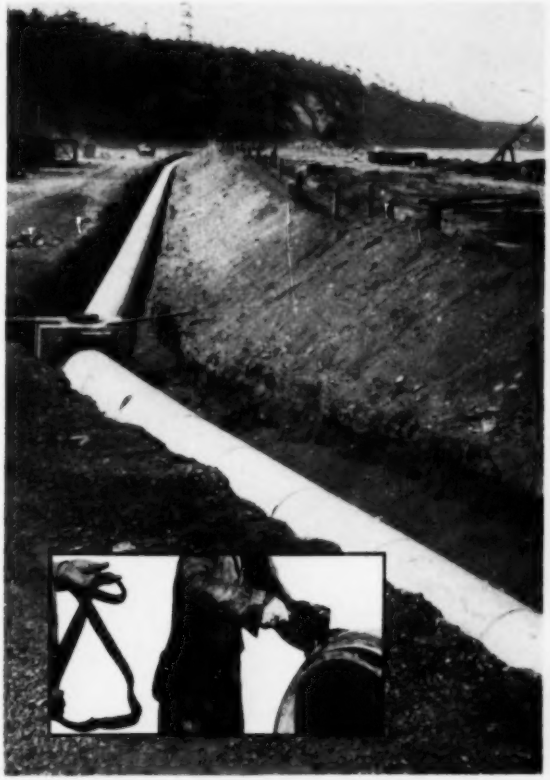
TO HANDLE 19,000,000 gallons of water per day at a pressure of 12 pounds — without leaks—was just part of the problem facing the engineers at Crown Zellerbach Corp. in the construction of the new supply line at Port Angeles, Washington. The line had to be laid along the shores of the Straits of Juan de Fuca — below sea level — on treacherously shifting soil — and, partially on a 1° curve. Low initial cost, minimum maintenance, and long life were also major factors of consideration.

Solution to this multiple problem was found in the use of reinforced concrete pipe and TYLOX flexible rubber joints — the "snap-on," permanently tight gaskets that make lines "leakproof for life"—on shifting soil—below the normal water table — or, "on radius." Easy to install and quick to couple, TYLOX joints also make possible lower "per laid foot" costs.

Take a tip from the Port Angeles job and solve tomorrow's tough pipeline problem with today's proved coupling — with TYLOX rubber gaskets.

Making Joints with TYLOX RUBBER GASKETS is as simple as ABC

Cement tongue and snap on Tylox gasket. Lubricate sliding surfaces with Tylox Cement. Shove the pipe home.



THUMBNAIL FACTS ABOUT THE PORT ANGELES JOB

Location: Port Angeles, Washington

Pipe: 1750 feet concrete pipe 36" x 8' SR (ASTM C-76-41). Manufactured by Port Angeles Concrete Products Co., affiliate of Graystone Concrete Products Co., Seattle, Wash.

Couplings: TYLOX flexible rubber joints

Engineers: Engineering Dept., Crown Zellerbach Corp.

Write, wire, or phone for specifications and literature on TYLOX Gaskets.

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"THE ONLY PERMANENTLY TIGHT LINES ARE LAID WITH RUBBER GASKETS"

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Important facts about pH for WATER & SEWAGE OPERATORS

WHETHER YOU ARE building a new plant or modernizing present equipment, one of the most important advancements you can make in either water or sewage plants is the installation of BECKMAN pH CONTROL. Through accurate pH control you can make *many* vital savings . . . savings that will quickly pay for the installation and will *continue* paying big dividends throughout the years. For example, some of the many benefits resulting from Beckman pH Control include . . .

WATER PLANTS: Maximum coagulation in settling basins . . . better control of chemicals and treatment during lime-softening operations . . . accurate control over alkalinity of finished water after recarbonation . . . reduction of corrosion in mains and pipe lines . . . and many other important savings.

SEWAGE PLANTS: Optimum sludge digestion . . . more efficient sludge filtration . . . better coagulation . . . accurate control over fluids discharged into rivers and lakes . . . and other vital savings in operating costs.

Write for full details.

TO MAKE CERTAIN you get the latest, most convenient and most accurate pH equipment, be sure to specify "BECKMAN" . . .

✻ Beckman pH equipment is completely electrometric, eliminating the mess and inaccuracies of colorimetric methods. Simply press a button and the exact pH of any process is instantly shown on a large easily-read dial. *It is the simplest of all pH methods!*

✻ With Beckman equipment no time-wasting or troublesome sampling devices are needed. Beckman pH electrodes may be installed directly in vats, tanks, channels or flow lines—and exact pH values read instantly—and *continuously*, if desired—on the process fluids themselves.

✻ The accuracy of Beckman pH readings is completely unaffected by human errors in color judgment, by turbidity, oxidizing or reducing agents, by suspended materials, colored process solutions or other variables that affect outmoded colorimetric methods. *Beckman pH readings are universally accurate and dependable!*

✻ Unique rugged-type Beckman Electrodes, especially designed for direct immersion in abrasive or suspension-laden fluids, reduce maintenance to an absolute minimum. *Beckman is the most trouble-free of all pH equipment!*

The above are only a few of many Beckman advantages. Write for the complete story.

There's a Beckman pH Instrument to meet your needs!

COMPLETELY AUTOMATIC! The Beckman Model R instrument operates directly from standard 110 v. A.C. lines to provide completely automatic pH indication. Also provides for completely automatic pH recording and automatic process control. Can be installed to give accurate pH readings from various stations in plant through one instrument. *This is the pH unit being installed by today's most modern plants, large and small.*

PORTABLE A.C. OPERATION! The Beckman Model H instrument can be quickly moved from one part of the plant to another and plugs directly into standard 110 v A.C. current. Compact, convenient and extremely simple to operate, the Model H gives *instant* pH readings on an easily-read dial. Widely used both for manual pH control of small plants and as an auxiliary instrument on completely automatic pH installations.

COMPLETELY SELF-CONTAINED! The Beckman Model N is the ideal instrument where complete portability is desired. Operating from its own self-contained, long-life power supply, the Model N can be used *anywhere*—in plant, field or laboratory—without dependence on A.C. power circuits. Features maximum compactness, simplicity and operating convenience, coupled with extreme ruggedness. Available in two types . . . the N-1 with separate Buffer, KC1 solution and beaker . . . the N-2 with integral case for Buffer, KC1 solution, beaker, thermometer, etc.

BRING YOUR pH PROBLEM TO US. Our trained engineers will gladly study your problem and recommend the equipment best suited to your particular requirements. No obligation, of course.

Write for literature on Beckman pH Equipment!

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MEMO

The Hagan Ring Balance Dual Meter is the most adaptable flow meter made . . .

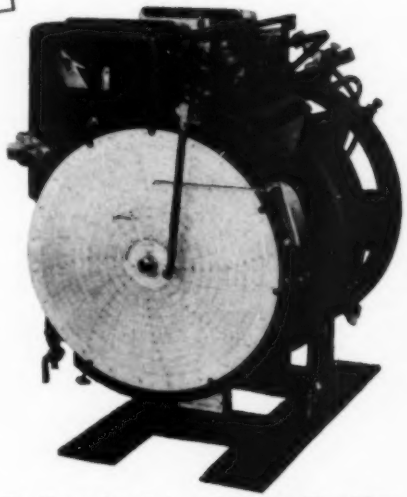
and here are four typical applications:

1. **MEASURE TWO INDEPENDENT FLOWS:** The Hagan Ring Balance Dual Ring Flow Meter will record two rates of flow on one chart, as, for example, steam flow and air flow, or gas flow and air flow.

2. **MEASURE TWO FLOWS SEPARATELY, ADD AUTOMATICALLY:** The Hagan Ring Balance Dual Ring Flow Meter will record flows from two separate lines, and integrate and record the total flow.

3. **MEASURE TWO FLOWS SEPARATELY, SUBTRACT AUTOMATICALLY:** For split flows, The Hagan Ring Balance Dual Ring Flow Meter will measure the main flow and the flow through one branch, record these flows and the difference between them, (this difference being the flow through the second branch), and will integrate any two flows automatically.

4. **FLOW MEASUREMENT CORRECTIONS AUTOMATICALLY MADE ON BASIS OF GRAVITY OR DENSITY:** One unit of the Hagan Ring Balance Dual Ring Flow Meter measures flow, the other measures gravity of a liquid or gas density. Records may show corrected or uncorrected flow rates, gravity or density measurement, with automatic integration of either flow rate.



The Hagan Ring Balance Dual Ring Flow Meter may also be compensated automatically for temperature and pressure factors.

For information on how Hagan Ring Balance Meters can solve your particular metering problem, write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

HAGAN CORPORATION

RING BALANCE FLOW AND PRESSURE INSTRUMENTS
THRUSTORQ FORCE MEASURING DEVICES
BOILER COMBUSTION CONTROL SYSTEMS
METALLURGICAL FURNACE CONTROL SYSTEMS

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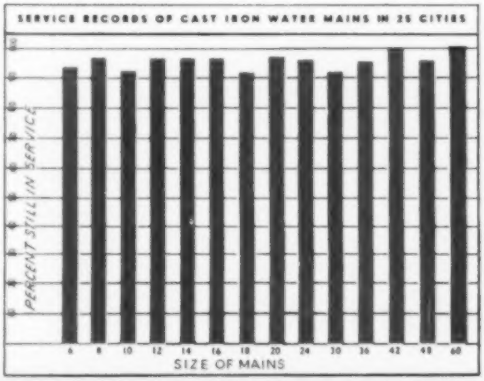
NIAGATHAL® (Tetrachloro Phthalic Anhydride)

No doubt about the stamina

Service Records of Cast Iron Water and Gas Mains
Pacific Ocean
Atlantic Ocean
Gulf of Mexico
• Black dots represent original cast iron mains in service w
* Red stars represent cast iron mains in service 100 years or more

AMERICA PROVES IT! The above map shows cities having some or all of their *original* cast iron water or gas mains still in service. The red stars indicate 34 cities having cast iron water or gas mains in service that were laid a century or more ago.

SURVEYS PROVE IT! A recent study directed by 3 Water Works Associations shows that 96% of all cast iron water mains, 6-inch and over, *ever laid* in 25 representative cities, are still in service.


SERVICE RECORDS OF CAST IRON WATER MAINS IN 25 CITIES
PERCENT STILL IN SERVICE
SIZE OF MAINS
6 8 10 12 14 16 18 20 24 30 36 42 48 60

CAST IRON PIPE

of CAST IRON PIPE...

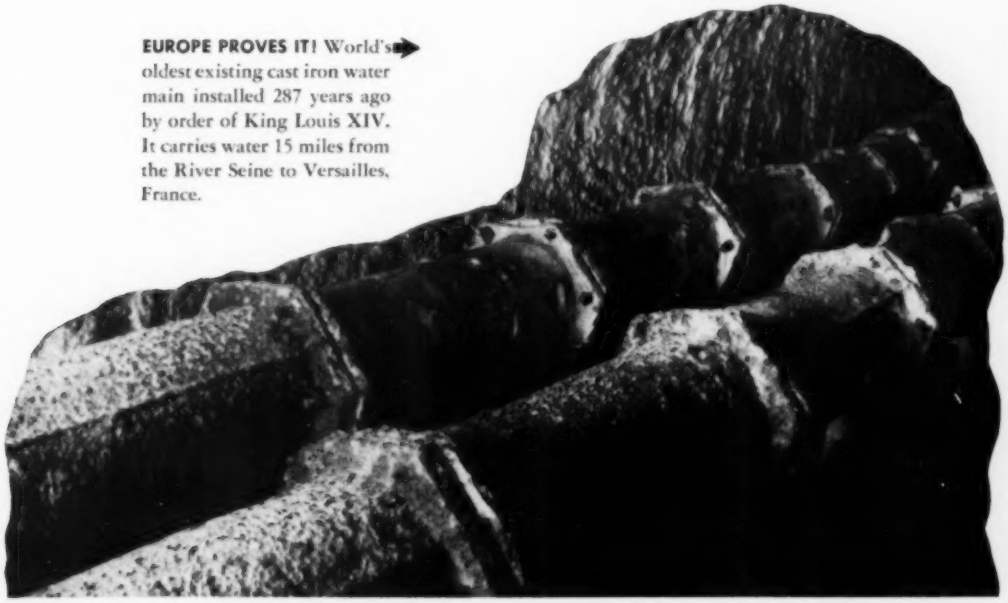
Europe proves it! The oldest cast iron water mains in the world, by authenticated records, supply the town and parks of Versailles, France. They were installed in 1664 and are still functioning after 287 years of service. Other cities in France, Germany and the British Isles have cast iron mains in service that are over 100 years old.

America proves it! Original cast iron mains are still serving 57 of America's largest cities. And 34 cities have either cast iron water or gas mains in service that were laid over 100 years ago (see map).

Surveys prove it! An exhaustive study, directed by a Joint Committee representing 3 Water Works Associations, shows that 96% of all cast iron water mains, 6-inch and over, *ever laid* in 25 representative cities, are still in service (see chart).

Yes, history proves beyond doubt that cast iron pipe has the stamina and the strength-factors that pipe must have to serve dependably under the paved streets of cities, towns and villages.

EUROPE PROVES IT! World's oldest existing cast iron water main installed 287 years ago by order of King Louis XIV. It carries water 15 miles from the River Seine to Versailles, France.

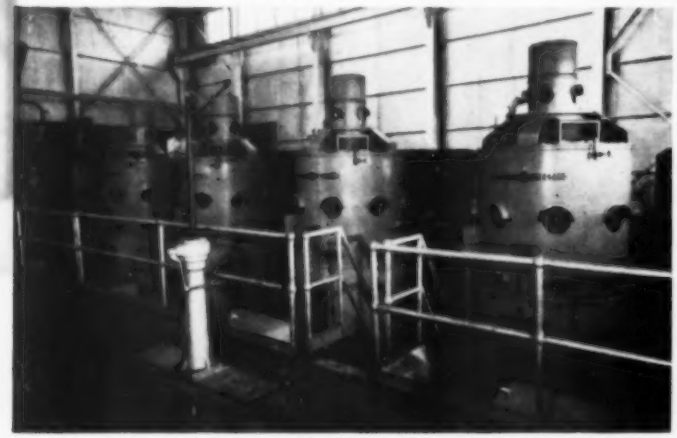


CAST IRON PIPE RESEARCH ASSOCIATION; THOS. F. WOLFE, MANAGING DIRECTOR, 122 SO. MICHIGAN AVE., CHICAGO 3.

SERVES FOR CENTURIES

NEW YORK CITY

Though dwarfed by the mighty Hudson River, this modern building houses equipment to supply the city 100 million gallons of water a day. Water is screened and chlorinated at the plant before being pumped to city reservoirs.



These G-E 2500-hp, 900-rpm, 4000-volt synchronous motors drive six Peerless vertical-turbine type pumps. Although they are on "standby," the motors are ready for continuous service should New York's reservoirs become low again.

For each pump motor there is a G-E totally enclosed panel with starting, stopping, and field control.

NEW! **More Power to America Water Supply Program**

Have you seen "Pipeline to the Clouds"? This full-color movie is part of G.E.'s new MPA Water Supply Program designed to develop public interest in local water supply conditions. For further details, write on your letterhead to *General Electric Co., Sect. 666-64, Schenectady, N. Y.*

CO-ORDINATED WATER-PLANT ELECTRIFICATION

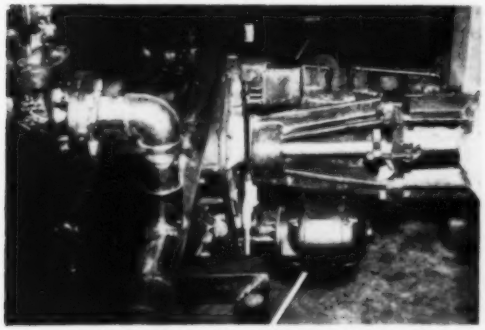
BUILDS NOW... FOR MORE WATER TOMORROW

Emergency pumping station at Chelsea, N.Y., completely G-E equipped, can supply 10 per cent of daily requirements during shortage periods

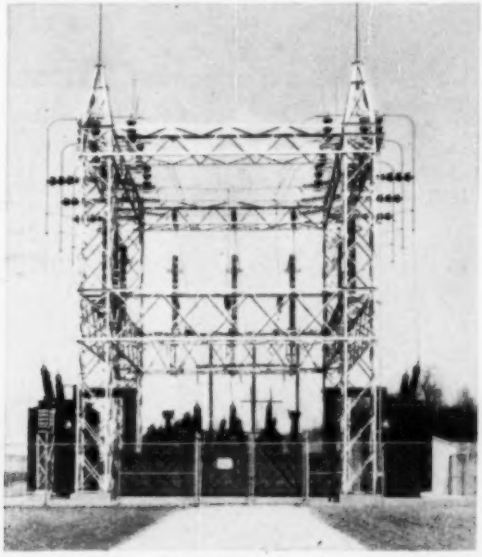
New York City's long-range plans to meet the increasing water demands of its growing population are centered on the mammoth, war-delayed Delaware Aqueduct project. The need for interim emergency provisions became apparent when the severe drought of 1949 seriously depleted city water reserves.

The 100-mgd Hudson River Pumping Station at Chelsea, N. Y., electrically equipped by General Electric, has been built to meet this temporary emergency. Now on standby duty, this station can supply a vital 10 per cent of the city's needs until completion of the first two stages of the Delaware Aqueduct. This project, now under construction and due about 1956, will make available an additional 500 million gallons of water daily.

Dependable G-E electric equipment is available for *your* water-supply expansion program. But more than that, G-E application engineers, working with your engineers and consultants, will help fit the right equipment—drives, substations, process controls—to your plant requirements. Call in your G-E representative early in the planning . . . when he can help most. *General Electric Co., Schenectady 5, N. Y.*



The gate-valve motor on the discharge side of each of the large pumps is used to close off piping for cone-valve maintenance. Other G-E motors power pumps which evacuate the wells to permit cleaning of the screens.



This G-E "packaged" substation supplies power for all station requirements, at 4160, 208, and 120 volts. Made up of factory-assembled components, these substations reduce engineering, simplify purchasing, and speed construction.

666-64

GENERAL ELECTRIC

Johns-Manville

Manufacturers of "Transite" Pressure Pipe

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*District Office

Here's How TRANSITE PRESSURE PIPE *Meets These 7 Basic Water Line Problems . . .*

IF YOU are faced with some—or all—of these 7 common water-line problems, here is information about Johns-Manville Transite* Pressure Pipe that may be of help to you . . . facts that tell how this modern asbestos-cement pipe is helping to solve these problems in many communities.

1. Handling costs:

Because it is light in weight and easy to handle, Transite Pressure Pipe keeps handling costs down. Loading, unloading, and all other subsequent handling operations are simplified. More footage can be hauled per truck-load—reducing trucking costs—and distribution along the trench is easier and more quickly accomplished. Moreover, mechanical handling equipment is not necessary except where larger sizes are being used; the pipe sections are easily lowered into the trench with rope slings.

2. Installation costs:

Transite Pressure Pipe offers important economies that help combat increasing costs of water-line installation. It is quickly and easily assembled in the trench. A coupling puller is the only tool necessary. Often, the pipe can be assembled so rapidly that the same foreman supervises both excavation and installation. The speed with which Transite is assembled means that the job is completed with a minimum of time and labor, thereby contributing important reductions in the overall cost of the system.

*Transite is a Johns-Manville registered trade mark

3. Soil corrosion:

Two factors give Transite Pressure Pipe exceptional resistance to corrosion: (1) the corrosion-resistant materials of which it is made; (2) the especially developed Johns-Manville process of manufacture which imparts a high degree of chemical stability to the finished pipe. This high resistance to corrosion has been substantiated by numerous installations. Many of these are serving as replacements in soils so destructive that the useful life of the pipe materials previously used had been seriously curtailed.

4. Internal corrosion:

Transite Pipe, because of its asbestos-cement composition, is not affected by tuberculation. Therefore, it is not necessary to resort to pipe of larger diameter to offset the internal effects of this costly form of pipe corrosion. And because progressive reduction of delivery due to tuberculation capacity is never a problem in a Transite pipe line, pressures and flows remain high—pumps operate at higher efficiencies. These factors are often reflected in better service and lower water rates in communities served by Transite lines.

5. Underground water losses:

Transite's success in combatting underground water losses is due to a combination of two factors: (1) the design of the Simplex Coupling used for assembly; and (2) the ability of the pipe to maintain its strength in service. The easily-assembled Coupling consists of a Transite sleeve and two rubber rings which form a tight, flexible joint. The ability of Transite to maintain its strength in service is due to its exceptional resistance to corrosion, as proved in thousands of installations under a wide variety of soil conditions.

6. Vibration and stresses:

Transite's flexible joints effectively absorb the vibration of heavy traffic—an especially important factor where pipe is laid under busy highways, or near railroad and street car tracks. Because each joint is capable of deflection up to five degrees, the entire line has a flexibility not ordinarily found in other types of waterline construction. This helps compensate for soil movements and other stresses to which the pipe may be subjected . . . provides an effective safeguard against costly pipe failures.

7. Maintenance:

In thousands of communities, Transite Pipe—with its advantages of joints that remain tight and flexible, its corrosion resistance, and immunity to tuberculation—provides low-cost water transportation that requires little, if any, maintenance. Transite lines do not have to be cleaned, lined, or replaced because tuberculation has reduced their original capacity. Reports from communities all over the country prove that Transite's asbestos-cement structure provides economies that continue through the years.

CLASSES, STANDARD SIZES AND APPROXIMATE WEIGHTS OF TRANSITE PRESSURE PIPE

Class (maximum recommended working pressure, psi)	*Equivalent head, feet of water*	*Nominal inside diameter, in.*						
		4	6	8	10	12	14	16
		Pounds per linear foot including coupling and rubber rings						
100	231	6.4	10.8	16.0	22.8	30.4	39.2	51.3
150	346	7.6	13.0	19.8	31.9	43.3	57.7	72.5

Designs from engineers' notebooks

screen chamber with EVERDUR screens

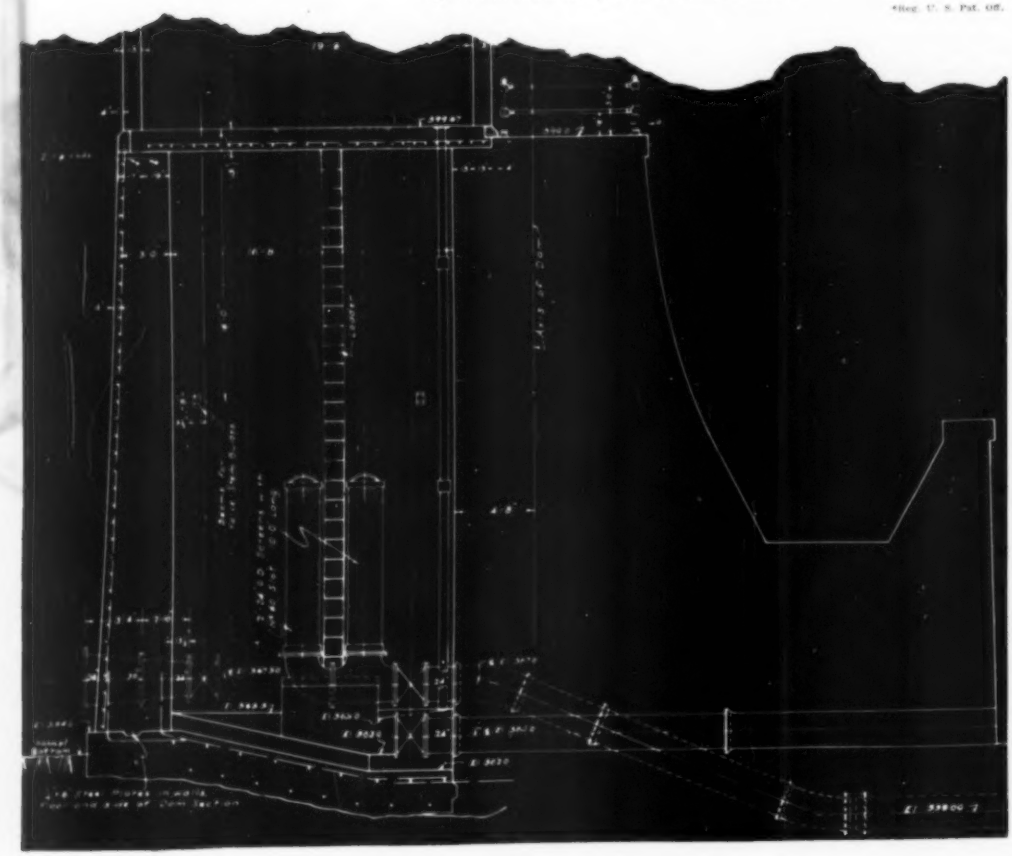
This water supply screen chamber and intake was developed by Malcolm Pirnie Engineers of New York. Advantages of this design are simplicity, complete absence of moving parts, use of standard Everdur* well screens and use of hydraulic backwash to clean the screens.

The use of Everdur for screens promises long screen life with a minimum of maintenance.

Everdur copper-silicon alloys provide an ideal structural metal for waterworks and sewage installations and wherever rust and corrosion are problems. They are strong, highly resistant to fatigue and easy to fabricate by oxyacetylene and electric welding into low cost, lightweight wrought metal assemblies.

Anaconda Technical Department engineers will gladly advise you on translating your designs into Everdur. Write to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 51142

*Reg. U. S. Pat. Off.

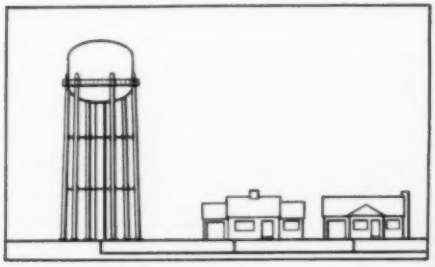


where corrosion resistance counts—consider **ANACONDA®** COPPER-SILICON ALLOYS

Horton Elevated Tank Reduces Power Pumping Costs 60 Per Cent in Allegan Water System

By filling this 250,000-gal. Horton elevated water tank during hours when both water demands and power rates are low, Allegan, Michigan has cut its pumping costs 60 per cent. These savings, combined with more dependable water service throughout the area, emphasize the importance of Horton elevated storage in the efficient operation of a modern water system. In many instances Horton elevated tanks have paid for themselves in a short period of time by reducing pumping costs, lower insurance rates, etc.

Horton elevated tanks utilize the *force of gravity* in their everyday performance. This means more dependable service even during emergencies. When nature does the work, mechanical or power failures do not disrupt service. Horton elevated water storage facilities are used by countless cities throughout the country. They've discovered those special features —high pressure, reduced pressure variations and decreased pumping costs—that mean more efficiency.



The illustration above shows how a Horton elevated water tank maintains gravity pressure in water distribution mains. By holding water above the surrounding homes, a Horton elevated tank provides dependable water pressure even during peak load periods. All Horton tanks for municipal installation are built in accordance with A.W.W.A. specifications.

Horton elevated water tanks with ellipsoidal bottoms are built in standard capacities from 15,000 to 500,000 gallons. Elevated tanks with radial-cone bottoms are built in standard capacities from 500,000 to 3,000,000 gallons.

For further details write our nearest office.

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WELDED STEEL

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Plants in Birmingham, Chicago, Salt Lake City, and Greenville, Pa.

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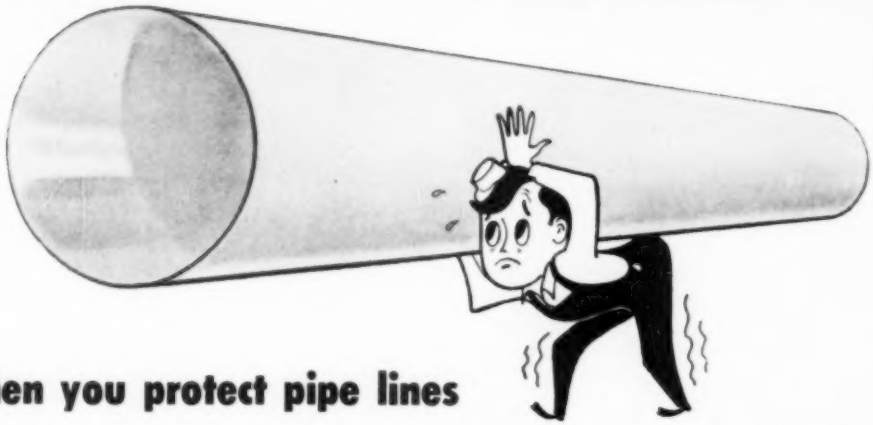
NO NEED TO SPECIFY OVER-SIZED PIPE



...when you protect pipe lines with BITUMASTIC® 70-B ENAMEL

PIPE LINES DON'T "SHRINK" when they're protected by Bitumastic 70-B Enamel. This durable enamel coats interior surfaces with a smooth, spun lining—a lining that prevents rust, corrosion and tuberculation.

With this kind of protection, there's no need to waste money on *over-sized* pipe in order to allow for future "shrinkage." You select pipe for your water lines solely on the basis of desired capacity.

Bitumastic 70-B Enamel saves money on pumping costs, too. That's because it *keeps* flow capacity high. It isn't necessary, even after decades of service, to install bigger pumps that cost more to buy and operate.

Bitumastic 70-B Enamel also protects exterior surfaces of pipe lines. It prevents pitting and leakage caused by soil corrosion. Here, again, you save money on maintenance and replacement costs.

It will pay you to protect your community's steel pipe lines with Bitumastic 70-B Enamel. If you wish, our Contract Department will handle your coating jobs from start to finish, furnishing skilled men and specialized equipment. Write for full information.

KOPPERS BITUMASTIC ENAMELS

KOPPERS COMPANY, INC., Tar Products Division, Dept. 261-T, Pittsburgh 19, Pa.

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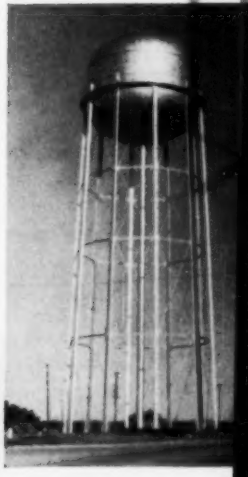
WHERE *Appearance* COMBINES WITH *Economy*

PITTSBURGH • DES MOINES

Double-Ellipsoidal *Elevated Steel Tanks*

Over a wide range of capacities up to a million gallons, the Pittsburgh-Des Moines Double-Ellipsoidal design offers low investment cost, excellent appearance and economical performance. It is one of the several P-DM Elevated Steel Tank types, meeting every water storage requirement.



Write for your free copy of our latest 24-page brochure, detailing many important aspects of modern water storage.

PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

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SANTA CLARA, CAL.	625 Alviso Road		

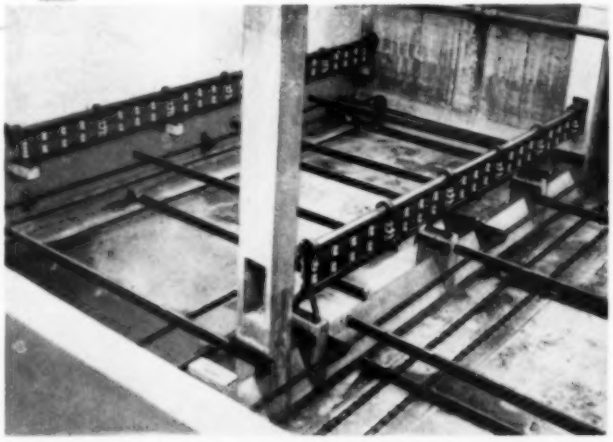
2 — 80'-0" diameter oxidators as installed at sewage treatment plant at Santa Barbara, California. 2 — P.F.T. 65'-0" diameter floating cover digesters in background. Koebig and Koebig, consulting engineers.

It's P.F.T. For PRE-AERATION

For CIRCULAR sedimentation tank P.F.T. offers the Oxidator. This unit, developed by Process Engineers, Inc. of California, combines pre-aeration and improved sedimentation in a single structure. The untreated waste enters the center pre-aeration chamber wherein it is aerated, mixed, and flocculated along with returned sludge solids. The aerated, flocculated material passes uniformly under the separating baffle into the upflow sedimentation compartment.

For RECTANGULAR sedimentation tanks P.F.T. offers pre-aeration in the inlet portion of the sedimentation tank structure, again combining the economies and advantages of complete conditioning of the waste by aeration and flocculation and improved sedimentation in a single structure. Upflow sedimentation with effective inlet distribution into the sedimentation compartment is a feature of this unit.

SEND FOR YOUR COPY OF BULLETIN No. 106 P. F. T. OXIDATORS



P.F.T. vertical plate holder pre-aeration equipment in inlet portion of primary sedimentation tanks at Stockton, California sewage treatment plant. Clyde C. Kennedy, consulting engineer.

PACIFIC FLUSH TANK CO.

Waste Treatment Equipment Exclusively Since 1893

4241 RAVENSWOOD AVE. CHICAGO 13, ILLINOIS

NEW YORK • LOS ANGELES • SAN FRANCISCO • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

Here's Double Quick Convertibility

Hydrocrane to Hydrohoe in less than 4 hours

For high-speed front-end convertibility, the Bucyrus-Erie Hydrocrane heads the list. An Illinois owner reports converting from crane to dragshovel front-end in less than four hours — with only the operator and one other man.

Here's How This Owner Does The Job — First the crane boom is lowered onto two specially-designed tripods. Necessary fittings are disconnected and the truck driven away. Next, truck is backed up to the dragshovel front-end which is held parallel to the ground by means of another tripod and the Hydrohoe dipper resting on the ground. Fittings are connected and the Hydrohoe is ready to begin work. Converting back to crane front-end is equally simple.

The owner remarked that the crane's fast convertibility not only means time saved on his own jobs, but it permits crane rental without fear of lost time converting back to the attachment needed on his own work.

Get full details on the fast-working, fully hydraulic Hydrocrane and Hydrohoe. Send the coupon today.

HERE the Hydrocrane digs a manhole. Every operation fully hydraulic: boom hoist, line hoist, swing, boom telescope, outrigger set and retract and bucket close. Available with crane hook, magnet, grapple, catch basin cleaning bucket and material handling bucket.

A quick field conversion — and here's your Hydrohoe. This smooth-digging outfit provides two separate digging actions: first, by means of a hydraulic ram located between boom and dipper handle; second, by telescoping the boom. This exclusive telescope feature eliminates moving truck back and forth when digging out boulders and excavating across pipe and cable ... permits digging a level, scallop-free trench.

Bucyrus-Erie Hydrocrane Division

South Milwaukee, Wisconsin

South Milwaukee — BUCYRUS ERIE HYDROCRANE — Wisconsin

Gentlemen: Please send Hydrocrane literature ☐
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For Quality Products

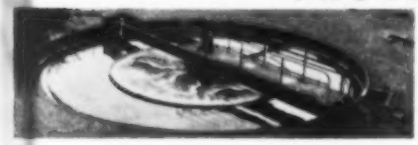
PROCESS ENGINEERS INCORPORATED

For new improved equipment that has been developed, demonstrated and proven — remember these products of Process Engineers Incorporated.

PROCESS CLARIFIERS

Above is pictured a type C primary Clarifier, 70 ft. diameter circular tank with rotating skimmer designed for the Indio Sanitary District of Indio, California. Engineers: Koebig and Koebig. Contractor: Kelly Construction Co. This rugged, built-to-last, trouble free Clarifier is another typical example of a Process Engineer Incorporated successful installation.

PROCESS OXIDATORS

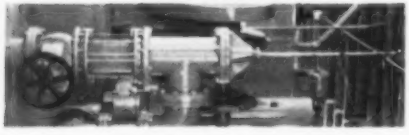


Process Oxidators include aeration, coagulation and sedimentation in a single circular tank giving the results of intermediate treatment at practically the cost of primary treatment. Installations mean lower initial expenditure, higher efficiency in operation and reduced maintenance cost.

PROCESS AUTOMATIC *Variable Level* SKIMMERS

This device automatically skims floating material from the surface of a liquid that varies in elevation by several feet. The difference in elevation between the liquid level and the lip for skimmings is adjustable and will maintain this adjustment during the up and down travel. The device is sensitive within 1/4" change in the liquid level.

PROCESS CLEANABLE SIGHT GLASS



A short section of special glass inserted in the piping system to make the contents visible to the operator. Applicable to sludge lines, supernatant liquor and other applications where it is desired to easily observe the character of the material being handled.

For complete information without obligation regarding any of the equipment described, communicate with any of the addresses listed below.

PROCESS ENGINEERS INCORPORATED

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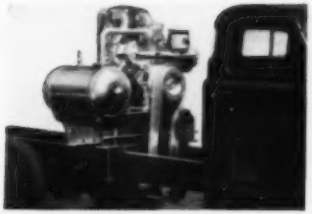
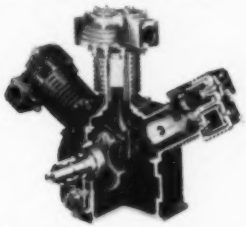
SAN FRANCISCO 8, CALIF.

6381 HOLLYWOOD BLVD.
LOS ANGELES 28, CALIF.

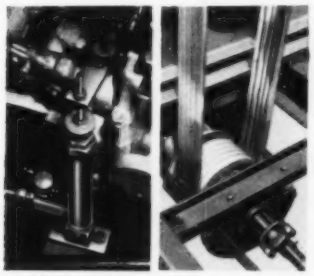
EASTERN AND MIDDLE WESTERN REPRESENTATIVE:
PACIFIC FLUSH-TANK COMPANY • 4241 RAVENSWOOD AVE., CHICAGO 13, ILL.



More Capacity: 125 cfm at 100 psi. Runs 2 heavy pavement breakers at full efficiency, with truck engine at only 1750 rpm.



Smooth Operation: No vibration under full load with this perfectly balanced 2-stage W-type compressor unit.



Simplest Automatic Control: Regulates engine speed to air demands without complicated linkage. Positive in action.

Cemco Power Take-Off: No gears. Only 4 moving parts. Clutch controlled from cab.

Utilities that never before used truck-powered compressors are installing the JAEGER TRAVEL-AIR

More air, no vibration, simple automatic control of engine speed—plus the advantages of power take-off

By taking power from your truck engine, which otherwise stands idle 7 hours out of 8, you save $950 to $1,000 in cost, 50% of the maintenance and all the extra weight and bulk of a separate engine and trailer mounting. Also saves waiting for engine to warm up at every job.

By using the air-cooled Jaeger 125 cfm compressor unit (largest selling compressor in the construction field) you get 20 cfm more air to run your tools at full efficiency.

Easy to mount on 1½ and 2 ton Chevrolet, Dodge, Ford, GMC or International trucks of long wheelbase current model. Get our Catalog TC-1, giving full information.

THE JAEGER MACHINE CO.,
680 Dublin Avenue, Columbus 16, Ohio
PUMPS • MIXERS • PAVING MACHINERY
SALES AND SERVICE IN 153 CITIES OF U.S. AND CANADA

Specify Carlon...

FOR LONGER PIPE LIFE

Combining the inherent advantages of plastic with the desirable characteristics of metal, CARLON plastic pipe is the superior new medium for fluid and gas transmission. Whether used for municipal water systems, sewage disposal, land drainage or other medium-pressure low-temperature applications, it assures more years of dependable, trouble-free service than ordinary pipe.

CARLON is absolutely guaranteed against rot, rust and electrolytic corrosion . . . is inert to the chemical action of corrosive waters and soils . . . and will not accumulate scale or sediment. It features light weight (only 1/8 as much as steel), flexibility, and ease of installation.

CARLON plastic pipe can be installed quickly without special tools or materials handling equipment. It is furnished in long lengths which require a minimum number of fittings. A complete line of molded plastic fittings is available for joining lengths of CARLON or for connecting this new pipe with previously installed metallic systems.

Specify the Pipe with the Stripe!

CARLON CP

CARLON PRODUCTS CORPORATION

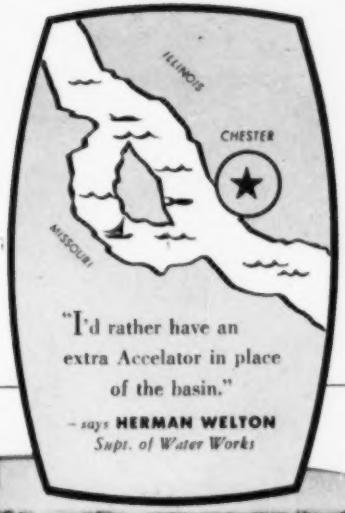
IN CANADA: MICRO PLASTICS, LTD., ACTON, ONTARIO

10300 MEECH AVENUE • CLEVELAND 5, OHIO

with the **Accelator**®

Chester, Illinois, no longer needs

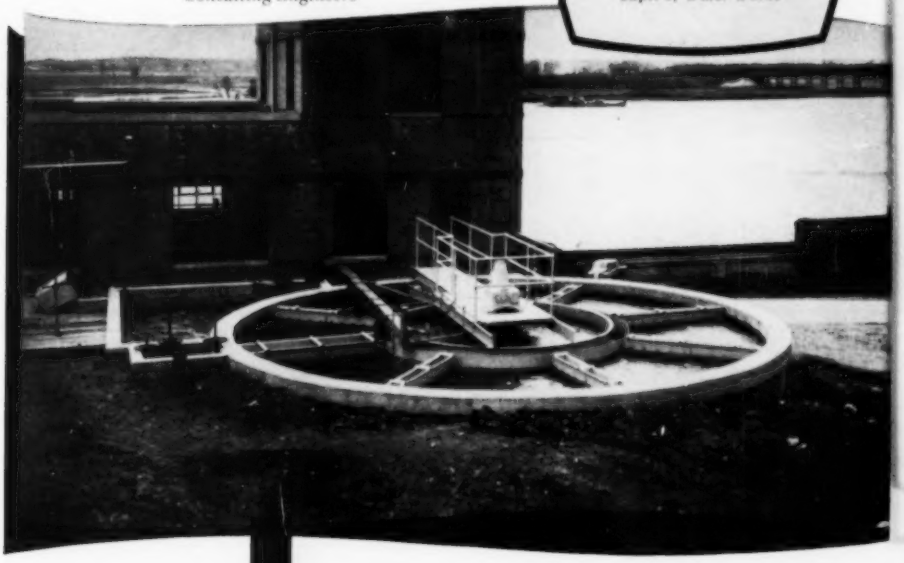
2-hour presedimentation basin...



"I'd rather have an extra Accelator in place of the basin."

– *says* **HERMAN WELTON**
Supt. of Water Works

RUSSELL & AXON
Consulting Engineers



CLEARER WATER FASTER
with exclusive slurry recirculation
SAVE UP TO 80%
in space (with lower construction costs)
SIMPLER OPERATION
– mixing, coagulation, clarification and sludge removal all in one unit
FASTER CHEMICAL REACTION
HIGH RATINGS

This Infilco plant at Chester, Illinois, handles 2,000,000 g.p.d. of Mississippi River water ranging from 400 to 4000 p.p.m. turbidity. The Accelator produces an effluent of 2 to 12 p.p.m. and is so efficient that a 2-hour presedimentation basin is no longer needed and has been taken out of service.

INFILCO
* BETTER WATER CONDITIONING * AND WASTE TREATMENT SINCE 1934

INFILCO INC. *Tucson, Arizona* | *Plants in Chicago & Joliet, Illinois*

FIELD ENGINEERING OFFICES IN 36 PRINCIPAL CITIES

World's Leading Manufacturers of Water Conditioning and Waste Treating Equipment

CLAY PIPE—*ESSENTIAL* • *ECONOMICAL* • *EVERLASTING*

Carloads OF CLAY PIPE used in defense expansion at North Haven, Connecticut

Wherever the nation's defense program calls for expansion, Clay Pipe is in demand. Its protection is inherent in the pipe — can't chip off, squash out, or wear away, because Clay is *completely* safe — inside and outside, top and bottom, through and through. Without it, essential construction would be slowed to a standstill, and our cities would be ravaged by sickness. It's the *only* chemically inert pipe unaffected by sewer gases — the only proved-by-performance pipe that *can't wear out*. Be sure to specify it on all your jobs.

In the defense expansion program caused by the building of Pratt & Whitney's huge new aircraft engine plant, North Haven, Conn., over 15,000 feet of Vitrified Clay Pipe were installed. The new lines connect into the expanded municipal sewerage system, assuring corrosion-proof, never-wear-out service for this vital defense area.

NATIONAL CLAY PIPE MANUFACTURERS, INC.

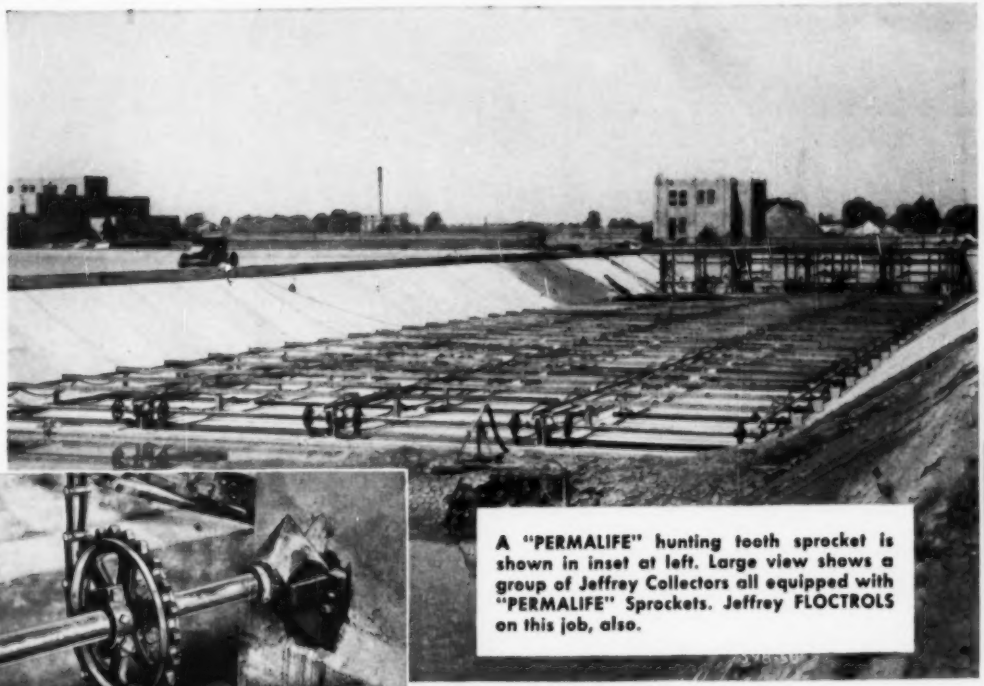
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio
703 Ninth & Hill Bldg., Los Angeles 15, Calif.
100 N. LaSalle St., Rm. 2100, Chicago 2, Ill.
206 Connally Bldg., Atlanta 3, Ga.

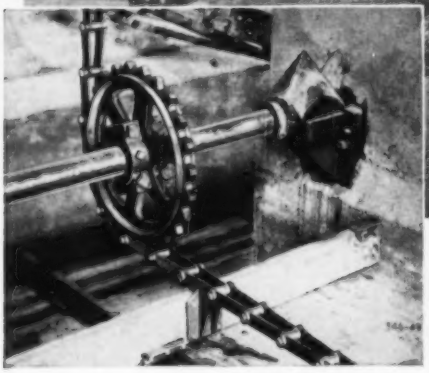
Wherever Reliable, Performance-Proved Pipe Is Needed, Specifications Call for Vitrified Clay

Rantoul, Ill. (Chanute Field)	158,000 ft.
Orlando, Fla. (Air Force Base)	74,000 ft.
Morrisville, Pa. (New Steel Defense Plant)	300,000 ft.
Rapid City, S. D. (Air Base)	54,000 ft.
Eynon, Pa. (Gun Fire Control Plant)	120,000 ft.
Marion, N. C. (Municipal Expansion)	32,000 ft.
Needles, Calif. (Essential Ore)	87,000 ft.
Tucson, Ariz. (Air Base and Defense Plant)	440,000 ft.

Vitrified
CLAY
CLAY PIPE NEVER WEARS OUT!
PIPE

C-152-1





A "PERMALIFE" hunting tooth sprocket is shown in inset at left. Large view shows a group of Jeffrey Collectors all equipped with "PERMALIFE" Sprockets. Jeffrey FLOCTROLS on this job, also.

It's the SPROCKETS THAT MAKE THE DIFFERENCE

Jeffrey Sludge Collectors are different (and last longer) when equipped with our hunting tooth "PERMALIFE" Sprockets of unique design. The sprocket has an odd number of teeth (approximately 3" pitch)—one tooth moves forward at each revolution. Over any period of time the sprocket teeth get approximately one half the number of contacts with the chain barrels as in the case of regular 6" pitch sprockets.

This feature, together with Chainsaver Rims which support the side bars of the chain, WILL DOUBLE THE LIFE OF THE SPROCKETS. Investigate these IMPROVED Sprockets—made of alloy cast iron and chilled.

Send for Catalog No. 833

THE JEFFREY MANUFACTURING COMPANY Established 1877

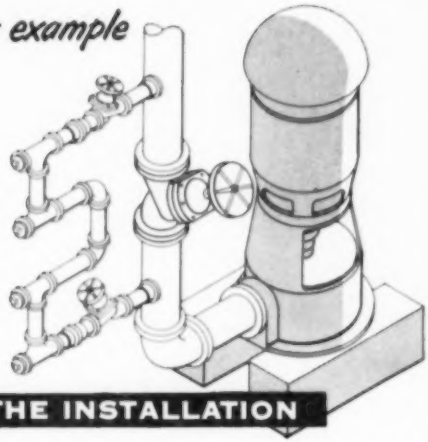
996 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

Baltimore 2, Beckley, W. Va., Birmingham 3, Boston 16, Buffalo 2, Chicago 1, Cincinnati 2, Cleveland 15, Denver 2, Detroit 13, Forty Fort, Pa., Harlan, Ky., Houston 2, Jacksonville 2, Milwaukee 2, New York 7, Philadelphia 3, Pittsburgh 22, St. Louis 1, Salt Lake City 1

Jeffrey Mfg. Co. Ltd., Montreal, Canada
British Jeffrey-Diamond Ltd., Wakefield, England
Jeffrey-Galion (Pty.) Ltd., Johannesburg, S. A.
The Galion Iron Works & Mfg. Co., Galion and Bucyrus, Ohio
Galion (Great Britain Ltd.), Wakefield, England
The Ohio Malleable Iron Co., Columbus, Ohio
The Kilbourne & Jacobs Mfg. Co., Columbus, Ohio

How's This For Solving a Valve Problem ...on Corrosive Well Water, for example



THE INSTALLATION

On outlet of well water pump supplying plant of Barr Rubber Products Co., Sandusky, Ohio. Sulphur content of water extremely high.

VALVE SERVICE RATINGS

SUITABILITY:
Just what was needed

MAINTENANCE COST:
None to date

CORROSION-RESISTANCE:
No evidence of corrosion

SERVICE LIFE:
Outlasted any 2 other valves so far

OPERATING RESULTS:
Pump shutdowns for valve repairs stopped

PRICE:
Much less than alloy valves

AVAILABILITY:
Stock item in Crane line

THE HISTORY

Valves formerly used here lasted no more than 6 months. Under constant exposure to severe erosive and corrosive effects, they failed to provide the easy operation and positive seating needed in this service. They required excessively frequent re-packing and seating maintenance.

Problem solved by replacing with Crane Packless Iron Body Diaphragm valves in main line and by-pass. Installed more than a year, they show no corrosion, no effects of service. Operate smoothly, seat tightly, with no maintenance needed to date.

THE VALVE

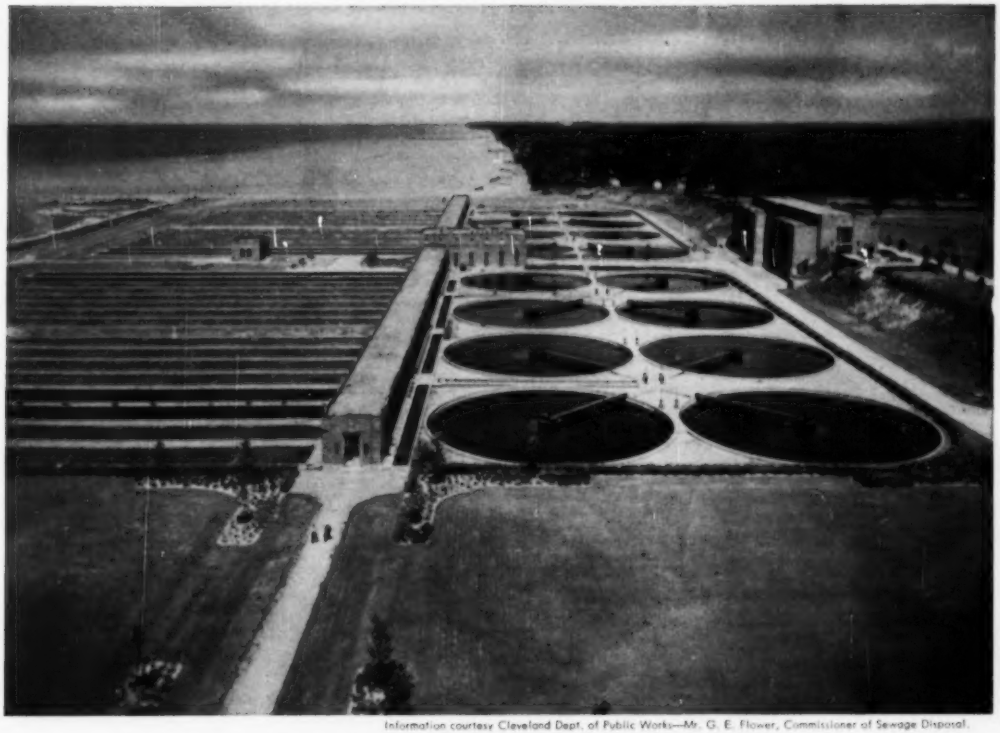
Crane No. 1611 Iron Body Packless Diaphragm Valves featuring separate disc and diaphragm. No packing to maintain; no stem leaks. Neoprene diaphragm used to seal bonnet only. Independent disc with neoprene insert insures positive seating even should diaphragm fail. Also fully neoprene lined valves. Many common and corrosive services. See your Crane Catalog or Crane Representative.

The Complete Crane Line Meets All Valve Needs. That's Why,
More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES · FITTINGS · PIPE · PLUMBING · HEATING



Information courtesy Cleveland Dept. of Public Works—Mr. G. E. Flower, Commissioner of Sewage Disposal.

Cleveland's Easterly sewage plant uses ALOXITE diffusers

The well cared for park-like area you see from Lake Shore Blvd. in Cleveland, opposite East 140th St., is actually part of this large Easterly Sewage Treatment Plant. Looking along the lake shore here, the aeration tanks, galleries, etc., can be seen to the left.

This modern plant uses the air diffusion process, employing ALOXITE aluminum oxide diffusers. This type of aeration gives the high degree of treatment – at low cost – essential to a densely populated area. It affords the necessary protection for Cleveland's water supply and bathing beaches. And it provides odor control which, of course, is vitally important.

The ALOXITE porous plates in this plant have been in service for a number of years, and have proved most satisfactory.

YOU'LL WANT OUR POPULAR BOOKLET. This new 56-page booklet covers different filtration and diffusion designs, gives pointers on material specifications, and outlines how to install and operate porous media in various units. It's complete with photos, charts, etc. Write for your free copy today.

Porous filter media and diffusers by

CARBORUNDUM

Trade Mark

Dept. M-22, Refractories Div. The Carborundum Company Perth Amboy, N. J.

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company.

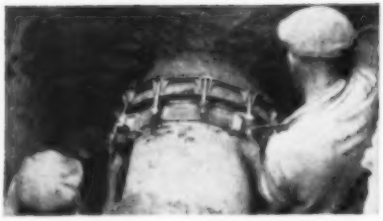
Ever dig up the same joint twice?

Then you've paid out more than the price of a permanent repair—*without getting permanence.* Recaulking may stop the leak temporarily, but it leaves you with a joint no better than the one that failed. It does nothing to combat the cause of the trouble.

That's why more water men every year are making it standard practice to repair all leaking bell-joints permanently with Dresser Style 60 Clamps. Style 60's are *flexible*-tight. Their resilient gaskets harmlessly absorb stresses which would cause repeated failures in rigid joints.

Obviously, the easiest and cheapest repair is to clamp the *first* time you have the joint uncovered. Next time, why not *make sure* of a permanent repair. Put on a Dresser Style 60 Bell-Joint Clamp.

Write today for literature and prices.



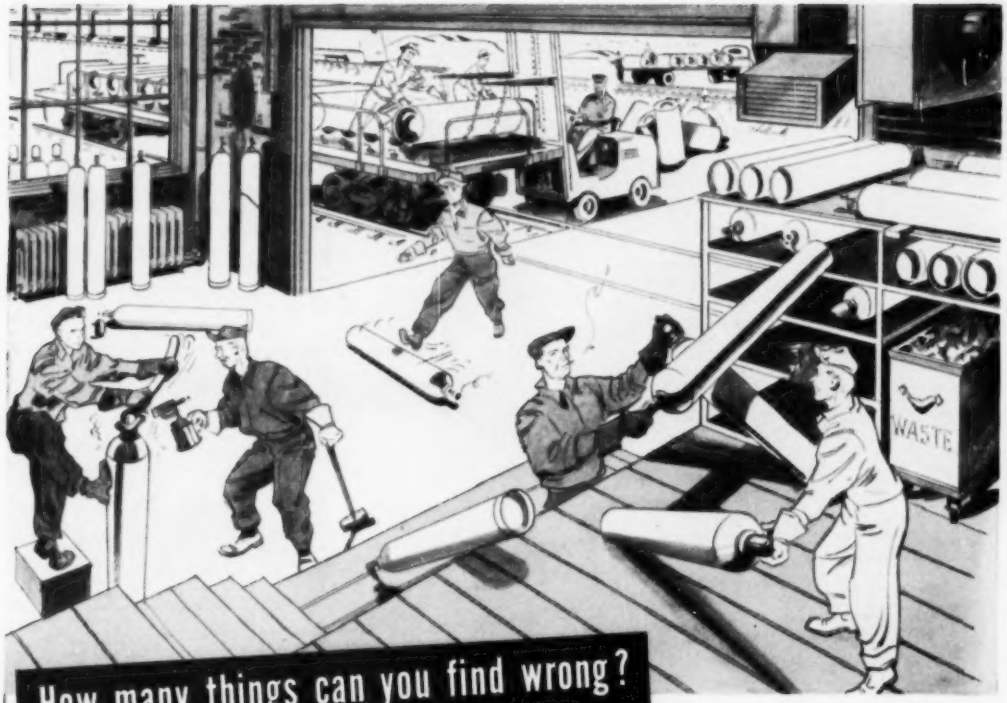
Fix it once... fix it for good!

DRESSER

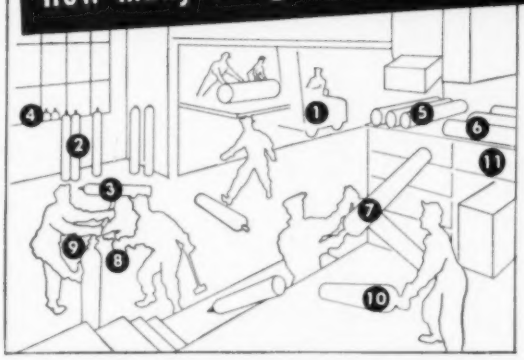
BELL-JOINT CLAMPS

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries)—In Texas: 1121 Rothwell St., Houston—In Canada: 629 Adelaide St., W., Toronto—Sales Offices: New York, Philadelphia, Chicago, Houston, San Francisco.

Chemicals you live by



How many things can you find wrong?



Answer drawing

1 Special hoists required for ton containers.
2 Cylinders must be stored away from steam pipes or other heat.
3 Empty cylinders need valve protective caps.
4 Both empty and full containers must have valve bonnets on.
5 Cylinders must be stored upright.
6 Do not store chlorine near ventilating systems.
7 Cylinders must not be dropped.
8 Do not apply heat to valves.
9 Never use a pipe wrench.
10 Do not lift cylinders by valve protective caps.
11 Do not store containers near flammable materials.

DON'T TAKE A CHANCE . . . Write for your free copy of DIAMOND's Chlorine Handbook. DIAMOND ALKALI's Technical Service department is ready at all times to help you with problems of handling, shipping or storing chlorine.

CHLORINE DEPARTMENT

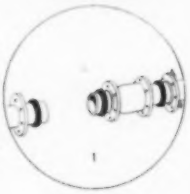
DIAMOND ALKALI COMPANY . . . CLEVELAND 14, OHIO

DIAMOND ALKALI CHEMICALS

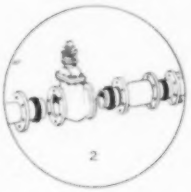
If you have to install a valve in a hurry--with an eye toward economy....

...specify EDDY Cutting-in Valves and Sleeves

After excavation and removal of section of pipe, glands and gaskets are placed on pipe and sleeve. The sleeve is then pushed into position.



Valve is placed between pipe end and sleeve, and pushed home against pipe. Sleeve is seated into bell of valve.



Glands, gaskets, bolts and nuts are then assembled at the 3 joints and tightened, using a ratchet wrench only.

Since 1849 EDDY For Long Service

EDDY VALVE COMPANY

A Subsidiary of James B. Clow & Sons

WATERFORD, NEW YORK

Starting with step "1" above, two men with a ratchet wrench can install an Eddy Mechanical Joint Cutting-in Valve and Sleeve on an existing pipeline in less than 25 minutes. Every joint is bottle-tight under pressure, without caulking or lead-melting. Thus, the work can be done in any kind of weather, or in a flooded trench. Valves meet AWWA specifications; are available in 3 to 12" sizes for sand-cast and centrifugally-cast iron water pipe. Stock up now, for speedy installations.

The right combination

FOR ANY WATER SUPPLY JOB

Layne offers you the right combination of unmatched experience plus modern equipment for installing well water supply units of any size—and for any purpose. Layne has made more water supply installations than any other firm in the entire world, and this valuable experience places Layne in a position to unquestionably do every job exactly right. Once the installations have been made, a complete record of everything is kept; strata formation, sand porosity, casing details, sand screen length, diameter and metal used, all pump information including bearings, shafting, impellers and operating characteristics. With such information, Layne is always in a position to give quick and most economical service for adjustments or repairs if and when needed.

Layne made the above well and pump installation to secure a constant and economical supply of cooling water for a large gasoline refinery.

When completed the above pictured well flowed more than 2 feet above the casing. With the installation of a Layne pump, the production was 1200 G.P.M.

LAYNE CATALOGS

Layne offers a wide range of fully illustrated catalogs covering every phase of well water installations, pumps, well cementing and sand screens. Your request for any will be answered promptly.

Everything by Layne

Layne accepts your contract for furnishing everything: Layne supervision, Layne drill crews, Layne drill equipment, Layne designed and Layne built louver type sand screen and Layne high efficiency vertical turbine pumps. No other firm is involved, therefore there is no divided responsibility. This plan gives you the very finest well water supply units that world wide experience and skill can possibly build.

LAYNE & BOWLER, INC.

General Offices, Memphis 8, Tenn.

Layne

WATER SUPPLY

WELLS & PUMPS

Ask Bulkley-Dunton

about **DISSOLVED AIR FLOTATION SYSTEMS**

for **SUSPENDED SOLIDS SEPARATION**

Bulkley-Dunton's staff of highly skilled Water Treatment Engineers specializes in developing systems and processes for the separation of

- **Suspended Solids** • **Oils and Greases**
- **Recoverable By-Products** • **Industrial Wastes** from process and effluent flows.

Many leading industries have availed themselves of this money-saving specialized Engineering Service to:

- Recover former waste materials
- Recover Water for re-use
- Solve Pollution Problems
- Augment Existing Facilities

Some of the many industries where Bulkley-Dunton can help you:

- Meat packing
- Paper manufacture
- Chemical production
- Carbon separation
- Soap manufacture
- Petroleum refining
- Petroleum production
- Railroad maintenance
- Fruit & vegetable canning
- Automotive industry
- Leather & tanning
- Glue & gelatin manufacture
- Beet & cane sugar refining
- Fish canning
- Wine distilling

It will definitely pay you to investigate Bulkley-Dunton's Water Treatment Engineering Services. Write for details to

ENGINEERING DIVISION

BULKLEY - DUNTON *Organization*

Division of BULKLEY, DUNTON PULP CO., INC.
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Pacific Coast: Security Bldg., Pasadena 1, Cal.

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There is a PUMP by Aurora for every pump job.
TYPE-OD
Aurora Horizontally Split-Case, Double Suction, Single Stage Centrifugal Pump.
For general water supply for municipalities, industries, office buildings, institutions—also—for handling liquids, chemical solutions, oils etc., in a wide variety of industries. Write for Bulletin 105-M for further details.

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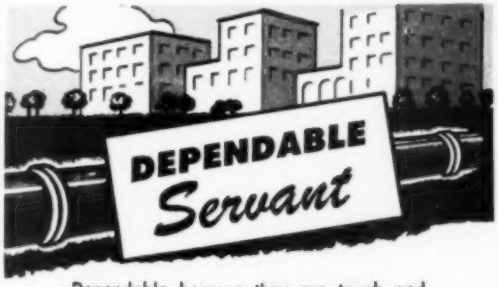

Dependable because they are tough and rugged. Made to withstand the wear and tear of the modern day strain and stress. For generations of incomparable service, only cast iron pipe can qualify. Serving the industry with Super de Lavaud Cast Iron Pipe, centrifugally cast, in modern long lengths.

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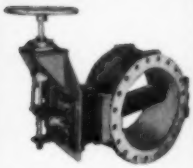
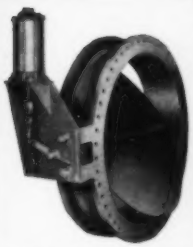
ALABAMA PIPE COMPANY

ANNISTON — ALABAMA

No. 797—24-inch heavy duty electric motor operated valve. Handwheel for manual use in case of current failure.



No. 700—20-inch class "B" cast iron valve equipped with heavy duty handwheel control and threaded reach rod.



No. 627—Cylinder operated 60-inch heavy duty valve (either pneumatic or hydraulic control).

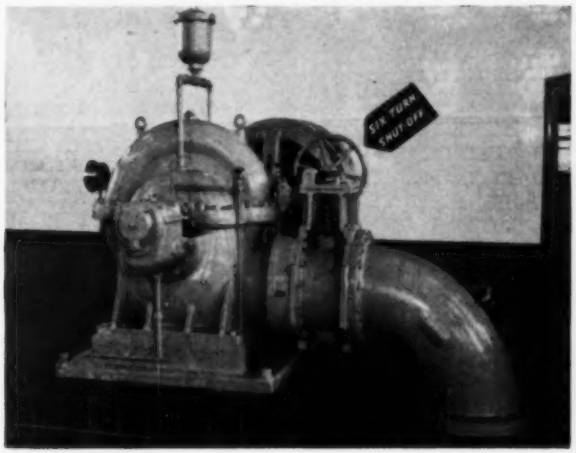
•

R-S Valves are synonymous with the simplified control and shut-off of any material that flows or is forced through a pipe, under a wide range of pressure and temperature.

•

R-S valvEvents

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •



ATLANTIC CITY *Simplifies* PUMP SHUT-OFF

New pumping units of the modern Atlantic City Pumping Station supplying water for this seashore resort are equipped with 125-pound handwheel operated R-S valves.

The valve illustrated above is closed in a matter of seconds (only six handwheel revolutions required) before the pump is started in order to prevent an overload on the pump and motor. The valve is then opened gradually and easily regulated according to demand.

Such valves can be equipped with hydraulic cylinders (tapped into the pipe line before and after the pump). As long as the differential pressure remains above a predetermined value, the cylinder will hold the valve open. Power or mechanical failure will cause a drop in the differential pressure, and the cylinder will close the valve automatically. Water hammer is impossible since the valve closes only as fast as the adjustable cylinder bleeds.

Specify R-S Valves for simplified construction and operation.

R-S PRODUCTS CORPORATION
4600 Germantown Avenue, Philadelphia 44, Pa.
An S. Morgan Smith Company Subsidiary

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THE SILENT WATCHMAN

DIXIE TANK AND BRIDGE CO.

3523 LAMAR AVE. **P. O. BOX 14**
MEMPHIS 1, TENNESSEE

Complete Service for Elevated Water Tanks—
Nation Wide Service—33 Years Experience

KEEP THE SAFETY FACTOR IN
YOUR TANK THE DIXIE WAY

By welding seams, pits and rivets which gives a riveted tank 15% more Safety Factor than it had when built. No rivets removed, water supply maintained while work is in progress. On completely reconditioned jobs, the painting is guaranteed for three years, repairs guaranteed for ten years, provided the tank is painted every three years by Dixie Tank and Bridge Company, making all adjustments, if any, without additional cost.

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SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

Dixie's Nation Wide Service Satisfies

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THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST

FLEXIBLES "Clean Up" KANSAS CITY UNDERGROUND!

. . . following the Flood Disaster

30 "**FLEXIBLE**" power bucket machines have been working in the Kansas City flood area since August! This is no doubt America's ***all-time-biggest*** sewer cleaning job. To aid the stricken area quickly, many cities from as far away as Ohio, Minnesota and Texas made their "**FLEXIBLE**" equipment available under "**FLEXIBLE**" supervision, in addition to those immediately supplied by the factory.

America recognizes "FLEXIBLES" with the Red Cross and National Guard as essential in emergencies.

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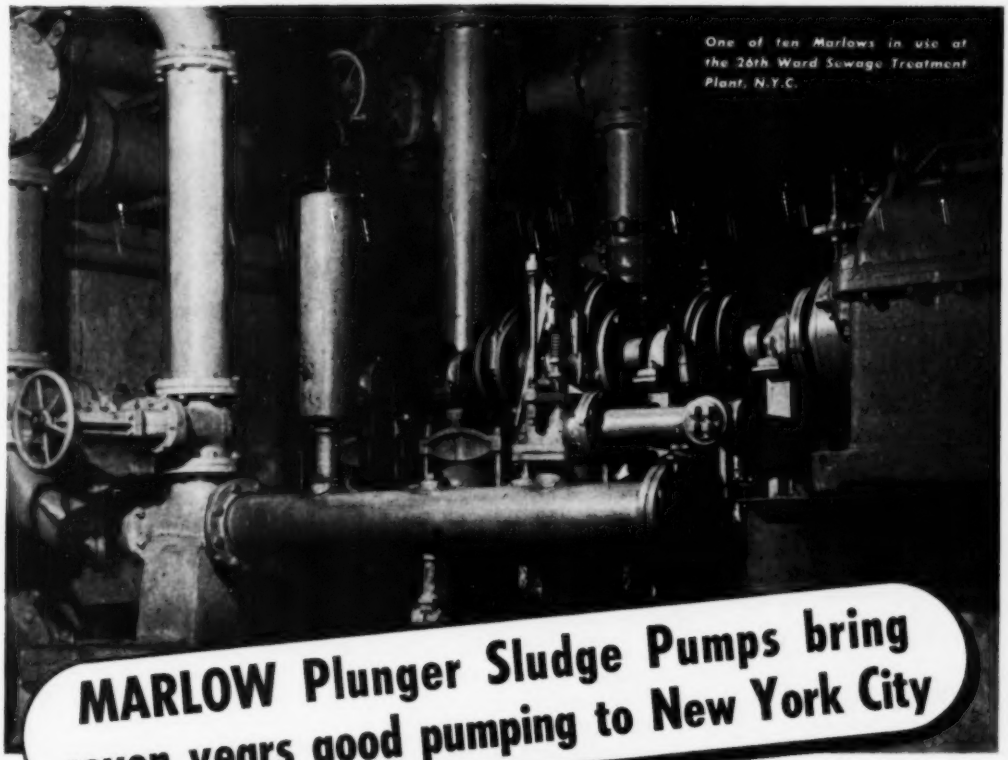
AMERICA'S LARGEST MANUFACTURER OF PIPE CLEANING TOOLS & EQUIPMENT



One of ten Marlows in use at the 26th Ward Sewage Treatment Plant, N.Y.C.

MARLOW Plunger Sludge Pumps bring seven years good pumping to New York City

. . . and MORE

Most of the ten Marlows installed in this big plant have been on the job since 1943. Four are used for primary sludge, one pumps grease from the primary system to digester, three handle excess secondary sludge and two pump digested sludge from digesters.

Other Marlow New York installations include the Bowery Bay, Jamaica and Coney Island Sewage Treatment Plants. Marlows are installed in over 400 municipalities across the nation. And still the list grows. At present, big Marlow installations are being made by the city of Baltimore, at Nut Island Sewage Disposal Plant in Boston and at the North Point Sewage Disposal Plant in San Francisco.

Marlows are preferred because they are more efficient, reliable and durable. Marlow Plunger Sludge Pumps are the result of years of advanced pump engineering. They are available with single, double, triple and quadruple plungers. 360 to 30,000 GPH standard displacement.

Write for details. Inquire also about the famous Marlow Self-Priming Centrifugal pumps — portable and stationary models — and Marlow Portable Diaphragm pumps.

MARLOW PUMPS

243 GREENWOOD AVENUE
RIDGEWOOD, NEW JERSEY

Manufacturers of the World's Finest Sludge Pumps

"Come on to my house . . .
it's next to WARREN
Cast Iron Pipe!"

Specify
WARREN
CAST IRON PIPE . . .

In all sizes from 2" to 84" with all types of joints . . . and WARREN Special Castings to meet your requirements for non-standard patterns.

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55 LIBERTY STREET, NEW YORK 5, N. Y.
Bell & Spigot Pipe • Flange Pipe • Mechanical Joint Pipe
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WARREN PIPE CO. OF MASS. INC. 75 FEDERAL ST. BOSTON, MASS.

95 Years of Continuous Service

"AT YOUR SERVICE" IN
KANSAS CITY

Just one block from the Municipal Auditorium — Convenient to business, shopping and theatrical districts . . . Tastefully Decorated Guest Rooms . . . Banquet Rooms . . . Club Rooms . . . Sample Rooms . . . Hotel Coffee Shop . . . Bar . . . Cocktail Lounge . . . Parking Facilities.

400 OUTSIDE ROOMS

RATES FROM $3.50 all with baths

THE HOTEL Commonwealth
BROADWAY AT 12TH
KANSAS CITY, MISSOURI

C-L-TWO Cleans All Types of CHLORINATORS

Keeping chlorinators clean with C-L-Two secures satisfactory operation and maintains rated capacity.

A Clean Chlorinator Denotes Careful Control

C-L-TWO has been field tested for three years in a large Midwestern Water Purification Plant and is now available to make a most difficult CHLORINATOR CLEANING TASK easy and economical.

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That's right!! TYGON PAINT offers "down the shelf" resistance — resistance to acids and alkalies alike. Many coatings offer acid resistance, some offer alkali resistance — but, in TYGON you get both — plus resistance to oils, greases, water, and many solvents.

Just stop and think of the number of different chemicals used in your plant every day. Then, think of the advantages of having one coating — TYGON PAINT — to provide the multiple resistance required. Think of the complete protection — the savings in time and money — the minimum inventory — the convenience assured by using just one positive protective coating, by using TYGON PAINT.

"Down the shelf" resistance is particularly important in the water and sewage field where defense is needed against an array of chemicals which includes lime, alum, ferric chloride, sodium silicate, chlorine, hypochlorite, copper sulfate, activated carbon, soda ash, ammonia, carbon dioxide, hydrogen sulfide, oils, greases, and miscellaneous acids.

Mixing and storage tanks, chemical feeders, bins, hoppers, conveyors, grinders, digestor covers, sludge scraper and skimmer arms, rotary distributors, filters, pumps and motors are typical of the water and sewage treatment equipment that can be fully protected against corrosive fumes and spillage with TYGON PAINT. Structural steel, piping, walls, and ceilings also benefit from TYGON protection.

In addition to its unusually high chemical resistance, TYGON PAINT can be applied by brushing or spraying — requires no more than normally good surface preparation. It dries quickly and gives a tough, smooth, flexible film that's non-flammable, long-lasting and easy to clean.

Why don't you try TYGON PAINT in your plant? You'll find it an economical, efficient answer to those troublesome, profit-eating corrosion problems.

Don't delay, write today for full details and technical information. Ask for Bulletin 720.

Address: U. S. Stoneware Co., Akron 9, Ohio
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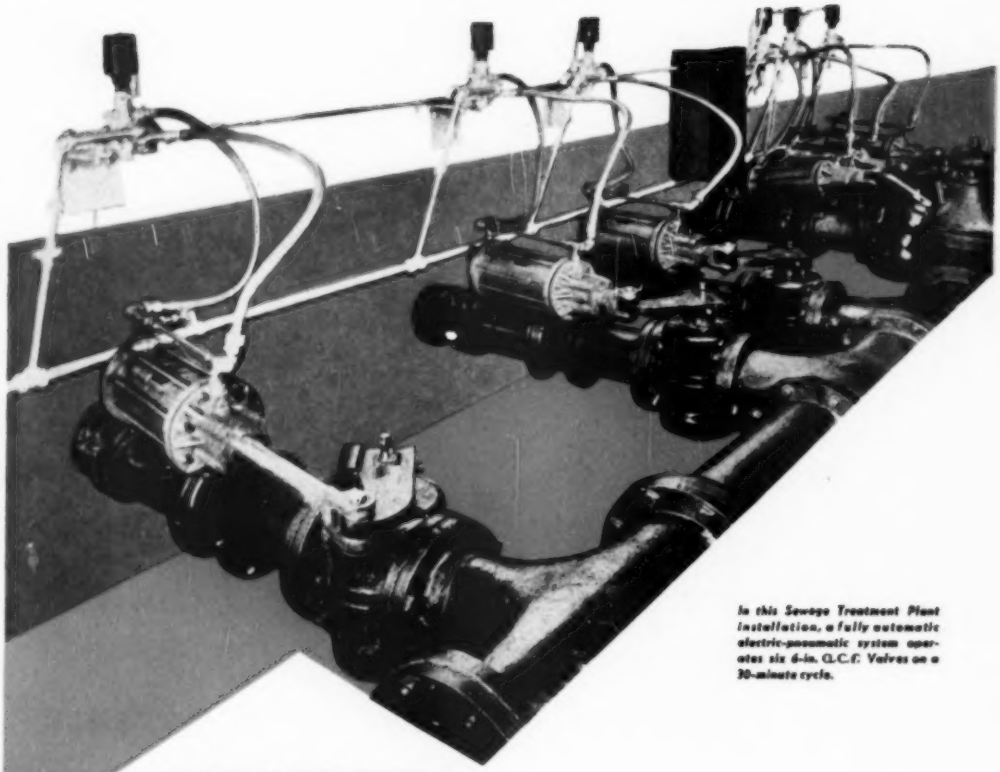

In this Sewage Treatment Plant installation, a fully automatic electric-pneumatic system operates six 6-in. A.C.F. Valves on a 30-minute cycle.

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It's a trend: it's becoming too costly to operate frequently-turned valves with manpower. Now, in the most up-to-the-minute plants, it's electrical timers, coupled to air or hydraulic cylinder, or electric motor valve controls. To avoid jammed-valve trouble on these automatic systems, most plants specify A.C.F. Lubricated Plug Valves. The cylindrical plug won't wedge in its seat... cuts tough, stringy obstructions with a powerful shearing action. For quick operation, a quarter-turn opens and shuts the valve. Too, there's the well-known advantage of a full-pipe-area valve port. In future designs, as in the past, A.C.F. Lubricated Plug Valves are first in the Sewage field.

a.C.f. CYLINDRICAL FULL PIPE AREA **PLUG VALVES**

Representatives in more than 50 principal cities

Ask for Catalog 4.WS, American Car and Foundry Company, Valve Division, 1501 East Ferry Avenue, Detroit 11, Michigan

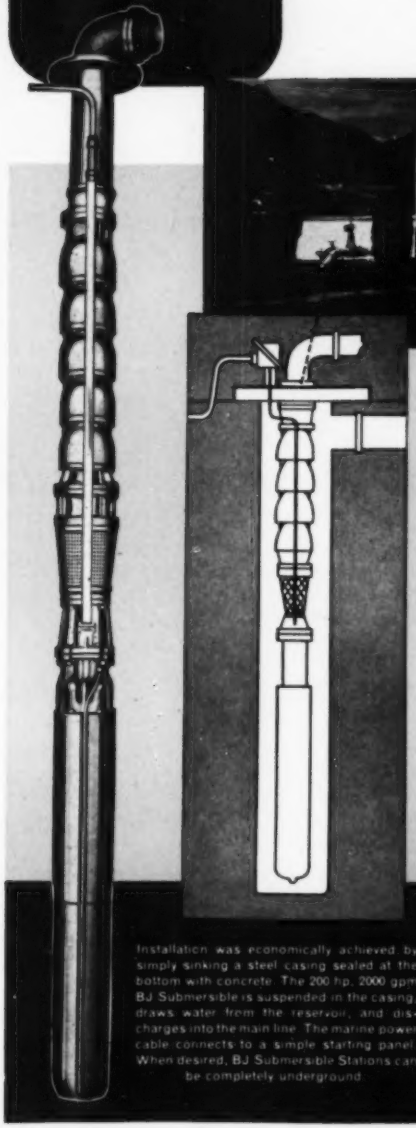
another

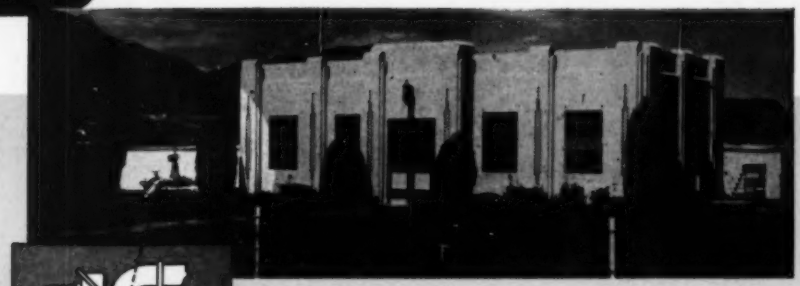
BJ

submersible pump

case history

El Paso's Invisible Pumping Station saves money, saves maintenance, and safeguards water supply in times of emergency





Installation was economically achieved by simply sinking a steel casing sealed at the bottom with concrete. The 200 hp, 2000 gpm BJ Submersible is suspended in the casing, draws water from the reservoir, and discharges into the main line. The marine power cable connects to a simple starting panel. When desired, BJ Submersible Stations can be completely underground.

The old and the new in pumping stations...

FIFTEEN YEARS AGO, the City of El Paso built a pumping station housed in the building above. This station uses 100 sq. ft. of space per mgd of pumping capacity, requires operating supervision and building maintenance. Now, El Paso has built another pumping station using a Byron Jackson Submersible Pump. This new, invisible booster station *uses only 12 sq. ft. of space per mgd, needs no pump house, and requires no operating supervision or building maintenance!*

According to E. Nevins, Production Superintendent of El Paso's Water Department..."today we feel that there is no real justification for a pump house. We have had such success with these submersible pump and motor combinations that all our future stations and wells will probably have them. Certainly, water-works officials will feel a lot better if their important pumping stations are underground, away from possible air attack and in a place difficult to sabotage."

BJ Submersible Pumps can help your city save unnecessary real estate investment, construction costs and maintenance expense, and safeguard your vital water supplies in time of flood, fire, war or other emergency. Pumping capacities to 20,000 gpm are possible and heads to 1500 ft. For additional data send coupon below or call your local Byron Jackson office.

Byron Jackson Co. Dept. No. 56

P.O. Box 2017 Terminal Annex
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Send me full data on the BJ Submersible

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POSITION _____ DEPT. _____

CITY _____ STATE _____

Photo Courtesy Rocky Mountain News, Denver, Colo.

A Picture
that speaks louder than words

A MAJOR break, in a 36" pipe line, floods a busy section of an important city, causing business to stop and an enormous financial loss.

To remove the possibility of great damage due to rupture of flow lines or force mains, Rotovalves, arranged for Emergency Line Check Service, should be installed at strategic points such as: river crossings, flood areas or congested business and residential sections.

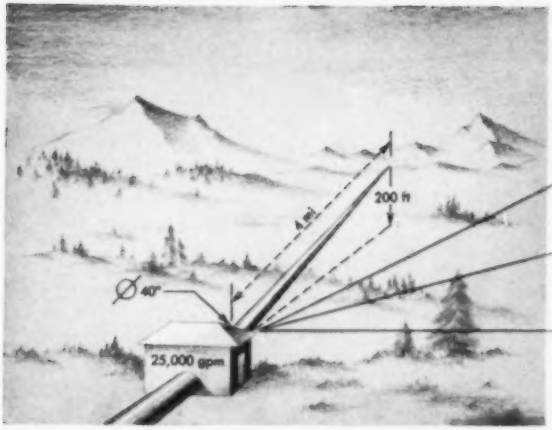
These valves will close automatically, in case excessive velocity exists in a pipe line, such as the rupture shown will cause.

As a double precaution, oil or water accumulator systems should be installed to prevent failure of the valve to operate, due to lack of water pressure.

Write for Rotovalves by Smith, Bulletin 140, and the suggestions of our Engineering Staff.

S·MORGAN SMITH COMPANY
YORK·PENNSYLVANIA~U·S·A·
If It's Hydraulics-Put It Up to Us·

POWER by SMITH



250 feet of head

525 feet of head

975 feet of head

?

CAN YOU PICK THE CORRECT ANSWER?

● **Here is the problem:** Estimate how high total pressure head could rise from surge if power failure brought the pump in this system to an abrupt stop.

25,000 gallons per minute are being pumped up an elevation of 200 feet in a total pipeline length of 4 miles. Pumping head is 250 feet. Pipe diameter is 40 inches. A check valve is used to stop backflow through the pump.

Make your guess, then here is the answer

Total pressure head could rise as high as 975 feet. Inertia of the upward moving column of water builds up great potential energy. As the water settles back against the check valve, a succession of dangerous pressure waves occurs, often sufficient to burst the pipeline.

THE PELTON SURGE SUPPRESSOR

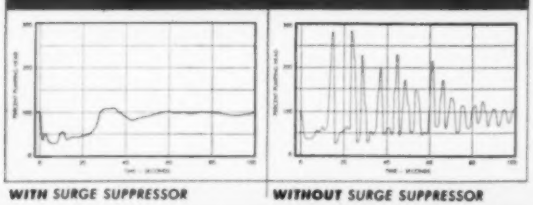
affords positive protection against this ever present danger — protection that no other valve gives.

Either current stoppage or pressure build-up actuates the **PELTON** Surge Suppressor. This quick-opening valve anticipates return surges and dissipates them by by-passing water around the pump; then it slowly closes as the pressure waves cease.

Lower pipeline costs can more than pay for a **PELTON** Surge Suppressor. Extra weight is eliminated because the pipe need not be designed with large safety factors in anticipation of high surge pressures. The possibility of line failures and interrupted service is greatly decreased.

Installations needing protection occur wherever water is pumped to a higher elevation either through a long pipeline or at high velocity. **PELTON** Surge Suppressors can be furnished to protect waterlines of any size handling service pressures up to 800 p.s.i.

Send us ***your*** *problem and include pipeline profile. Our engineers will make recommendations without obligation.*



WITH SURGE SUPPRESSOR ***WITHOUT SURGE SUPPRESSOR***

The PELTON WATER WHEEL Company

Subsidiary of Baldwin-Lima-Hamilton Corporation

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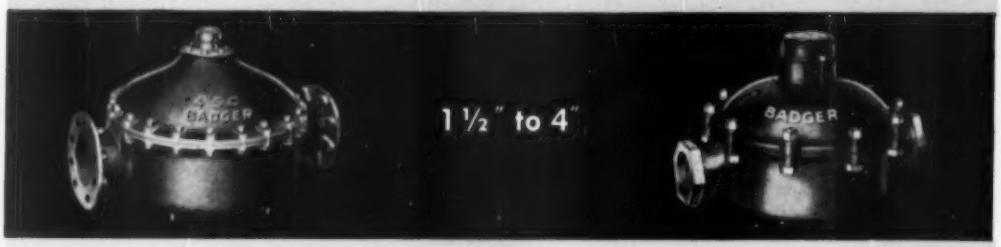
BALDWIN BLH LIMA-HAMILTON

there's a RIGHT SIZE and RIGHT TYPE



# of BADGER *Precision* WATER METER

for every water meter service

Badger makes the meters you need . . . any type, any size, for any water-measuring job in home or industrial service: 5/8" to 1 1/4" home service meters; 2" to 12" Turbine (Current) Meters; 2" to 10" compound meters and industrial meters...of many sizes and types...also time-and-money saving accessories vital to efficient installation and servicing, including famous Badger Meter Testing Machines. For complete meter service, it pays to contact Badger.

"MEASURING THE WATER OF THE WORLD"

First for Accuracy • Low-Cost Maintenance • Durability • Sensitivity

BADGER *Water* METERS

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Worcester, Mass. • Savannah, Ga. • Cincinnati • Chicago • Kansas City • Waco, Texas
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DEPENDABILITY AND PROVEN WORTH IN THE MUNICIPAL WATERWORKS FIELD

Communities from villages to cities have found that McDonald Waterworks products serve faithfully with a minimum of service. Here are two cast iron Service Boxes: top, the E-5601 "Arch Pattern", extended lengths from 2 to 8 feet, and bottom, the E-5614 Minneapolis Pattern, (cutaway) extended lengths from 2 to 8½ feet. Write us for particulars concerning our full Waterworks Line.

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BRASS GOODS • PUMPS • OIL EQUIPMENT

EST.
1856
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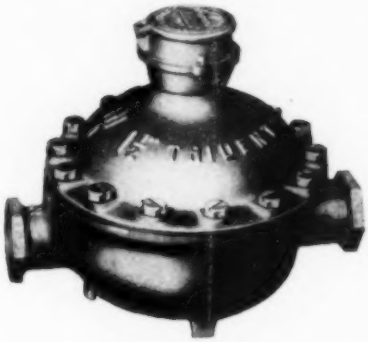
There's more to do taking care of TWO...

MORE TROUBLE
MORE EXPENSE
TWICE AS MUCH TO GO WRONG

THE SAME APPLIES TO WATER METERS



That's why experienced Water Works men prefer

TRIDENT "STYLE 3"

1½" and 2"

to the more complicated

COMPOUND

DOES THE WORK OF TWO METERS AND DOES IT BETTER

As makers of Compound Meters ourselves (we made the FIRST Compounds) we are in a position to say with authority that the Trident Style 3 is much simpler, costs less to buy and maintain, is just as accurate, and produces just as much revenue over a wide range of flows, as ANY 1½" and 2" Compound, including our own. This has been proved over a period of years. Ask your Trident representative for further data.

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235

WATER & SEWAGE WORKS

VOL. 99, NO. 2 • A GILLETTE PUBLICATION • FEBRUARY 1952

COMPLETED—Los Angeles' 245 mgd. plant at cost of $42,000,000, which will cost about $1,000,000 a year to operate.

Sewage and Industrial Waste Treatment - 1951

A review of progress, developments and trends of the year.

by EARNEST BOYCE,* *President Federation of Sewage & Industrial Wastes Assn's. Ann Arbor, Michigan.*

A COMBINATION of factors has made 1951 a significant year in the progressive development of plans and policies for the better protection and utilization of our water resources.

Progress in a field as broad as that of sewage and industrial waste disposal results from the integrated efforts of all who serve the cause of water quality control. It results from the work of many individuals as they gain in skill and knowledge and thus became more effective in accomplishing their respective tasks.

It represents the efforts of the scientist in his research laboratory, as he attempts to establish the chemical and biological principles that will govern the design of processes for the removal from the "used water" of community and industry of those substances that will detract from its further usefulness.

It represents the work of the biochemist and the statistician as they measure and evaluate the capacity of natural waters to receive and assimilate pollutional residues not removable by known methods of treatment.

It results from the planning of the engineering practitioner as he develops the designs and constructs treatment facilities to meet the influent loading demands and the effluent quality standards that each situation requires.

Finally, and of *great* importance, it represents the considered judgment of public bodies charged with the responsibilities of government in its legislative, executive and judicial aspects and their interpretation of public policy. As we survey the achievements of 1951 in retrospect we find an area of unusual progress in the educational activities directed toward developing a public consciousness of the existence of water resource problems and that sewage and industrial waste disposal is a basic factor to be considered in water utilization and programs of water conservation.

We have at last realized that the facts and figures of scientific and technical groups have little direct application in planning an educational program for the average well informed man. While our information has been well documented and factual and our

Cover Picture

There is no reference elsewhere in this issue to the picture which appears on the cover. It was used to denote progress being made in pollution abatement by industry, and was originally intended to accompany Prof. Boyce's review. The twin clarifiers are Walker "Clariflo" units, removing flue-dust and other settleable solids from blast furnace and steel mill operations at the Jones & Laughlin Steel Co.'s plant in Aliquippa, Pa.

*Chairman, Dept. of Civil Engineering, University of Michigan, Ann Arbor, Mich.

technical literature excellent, its circulation has been within a group already interested and consequently there has been little incentive to develop reader appeal. We now know that a story is not newsworthy unless and until it possesses reader appeal and that the mere accumulation of facts and data does not produce this interest. It is necessary that these data be broken down into units that can be assimilated by the nontechnical mind and administered in dosages that stimulate the reader's appetite for for more information.

Publicity and Public Relations

We have learned from the psychology of advertising that public interest can be aroused and stimulated in subjects more mundane than B.O.D.

In 1951, the U. S. Public Health Service, acting under the provisions of the Taft-Hartley Bill (Public Law 845) and in compliance with its injunction to "collect and disseminate information relating to water pollution and the prevention and abatement thereof", published a factual but brief resume of the over-all water pollution problem in the United States. It is an attractive publication printed on good paper, well illustrated and compares favorably with the format of a high-class advertising brochure.

"Water Pollution in the United States"—Water pollution Series No. 1—(through the Superintendent of Documents—35c) has been published in a form that will attract the attention and stimulate the interest of the casual reader. Its 44 pages present the story of pollution from domestic sewage and industrial waste through pictures, charts, and simple diagrams. In strictly non-technical language, it informs the reader that, despite the reduction of the pollutional load on the surface waters of the United States by the functioning of 6,700 municipal and 2,600 industrial waste treatment plants, the wastes still discharged are equivalent to the untreated sewage from a population of 150,000,000. The reader learns that 10,000 new waste treatment plants, replacements, and additions or enlargements are needed to keep up with the population growth and industrial expansion of the next decade. He also learns that from $9,000,000,000 to $12,000,000,000 of public and private investments will be required. He is made aware that progress is being made with 440 plants under construction and with plans approved for an additional 2,300 plants. In four pages of tabular information the more inquiring reader will be able to find a rather detailed breakdown of data regarding municipal and industrial sources of pollution in the fourteen Drainage Basin Areas of the U.S. and the existing and needed treatment facilities. The reader is made to feel a personal responsibility for doing his part in securing clean streams—and he can understand that the cost is within reason when it is expressed as "the price of a daily candy bar" per family.

But for some the story of river pollution will need to be spelled out in the very simple language of the comic page of the Sunday daily. The technical reader may look askance at the 16 page Public Health Service booklet that tells the pictured story of water pollution and water borne disease through the experiences of "Mark Trail," the woodsman and the lover of the great outdoors, but if he wants the simple but understanding support of the majority, he will have to realize that the educational start will have to be made at the level of the learner's interest. The Public Health Service is to be commended for its use of an educational technique that should do much to make the subject of stream sanitation newsworthy and to thus stimulate interest in and through the non-technical press.

INDUSTRIAL WASTE treatment plant of Congoleum-Nairn Co.'s Cedarhurst, Md., plant.

The Service, however, has not been alone in this attempt to develop public interest in pollution control. Important as are the health implications of pollution abatement, there are other aspects that merit public support and other groups that have a coordinate interest in clean streams. Recreational and wild life groups have repeatedly stimulated public interest through stories of the tragedy of uncontrolled pollution of resort and fishing waters only to allow an incipient public support to subside through a failure to follow through with suggestions for feasible correction. These efforts, however, have not been without their effect in producing a deep seated public resentment and a nostalgic hope that the old swimming hole can again be safe from pollution.

Industry Undergoing Change in Viewpoint

Industry, always alert and responsive to the value of public good-will, is beginning to recognize the capital worth of an active program of industrial pollution control, not only from the standpoint of protecting a limited and essential resource, but also from the standpoint of consumer reaction. The prize winning documentary film "Clean Waters", produced in color by the General Electric Company, is an excellent example of how to win friends and influence the public to support a constructive approach to clean streams.

The third annual report of the Ohio River Valley Water Sanitation Commission, an educational document in its own right, pays tribute to the cooperation and support that the industries of the Ohio River Valley are providing through "industry action committees."

These committees have been organized for the following purposes:

1—"To promote within the ranks of their specific industry an appreciation of the need to minimize pollutional wastes.

2—"To assemble facts and make an appraisal of the waste disposal problems of the industry with specific reference to conditions in the Ohio River Valley.

3—"To consult with the Commission in the establishment of water-quality objectives and treatment requirements.

4—"To encourage joint research and development of more effective control of waste discharges through better housekeeping or by treatment measures.

5—"To maintain liaison, through the Commission, with other industry committees for the pooling of knowledge and the dissemination of information."

The Report indicates that several committees are still in the discussion stage, four committees were operating during 1951, and that a fifth has just been organized. Each committee operating within a specific industry has the benefit and guidance of the experts within its special field.

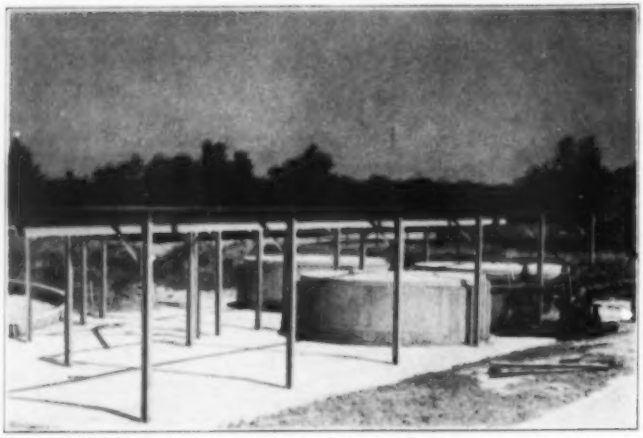
The active committees represent the metal-finishing, steel, distilling, chemical salts, and coal industries.

The metal-finishing committee is concerned with the wastes derived from chemical and electro-chemical surface treatment of metals and related cleaning processes. This includes such operations as electroplating, electrotyping, anodizing, electropolishing, phosphating, and the coating of plastics.

Through five active sub-committees, special aspects of the disposal problem are being studied. One group is concerned with toxicity limits and is coordinating its work with the Commission's research program at the Kettering Laboratory of Applied Physiology, located in Cincinnati, Ohio.

Another group is studying the workability, desirability and economy of various methods of treatment in relation to the disposal of metal-finishing wastes. As an example of the cooperation available through this single industry supported special sub-committee, it has already reported on eleven different methods of cyanide

REVITALIZED—Baltimore's 40 year old plant completely modernized to treat 260 mgd. Original battery of circular Imhoff tanks appear in extreme left center. Suds-covered activated sludge plant just beyond.



GAS SCRUBBERS at Oklahoma City's new Southside Treatment Works protect gas engines.

waste treatment in addition to a study of methods for the removal of oil and sludge and the control of acids in plant wastes.

One sub-committee is studying analytical methods for the determination of extremely small amounts of impurities to be found in metal-finishing wastes. Another sub-committee is concerned with the in-plant waste control measures and the development of good "plant housekeeping" practices.

The steel industry committee is concerned with the subjects of coke plant effluents, acid pickle liquor and the removal of settleable solids. Other committees are actively studying problems appropriate to the several industries represented.

These activities are of great significance, not only in that they represent a welcome addition to the research resources devoted to the study of industrial waste disposal, but of even greater importance, they mark a significant change of attitude on the part of "big business." Forward looking industrial management is no longer refusing to recognize its stream pollution abatement responsibilities in the mistaken fear that in so doing it might prejudice its position in a damage claims court.

The Ohio River Commission report also recognizes that progress will require the continued stimulation of public interest through a well organized educational program. The statement is made that "A fundamental of Commission philosophy is that solid accomplishment in the clean streams campaign can be achieved only with the support of an informed, convinced, and aroused public. Technical investigations, hearings, and the application of legal restraints form an essential and important part of the program. But the real momentum—the desire to do—must be instilled in the people, in the communities in which they live, and in the industries of the region." In addition to news releases, magazine articles, speeches, and radio interviews, the Commission is extending its educational activities to include the development of "community action" programs.

Activity of Industry Noteworthy

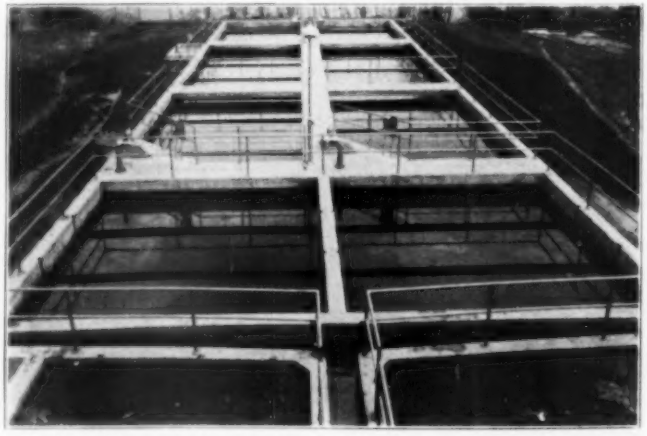
A review of the activity of industry in promoting stream sanitation through the support of research study of waste disposal as it affects its public and operational relations, would not be complete without noting the industry-wide work of the National Council for Stream Improvement (of the Pulp, Paper, and Paper Board Industries) Inc., as recorded in its 1950 Annual Report. Industry sponsored, its 220 members have actively supported research projects for the development of waste curtailment and disposal methods adapted to the various types of pulp and paper processes. It has also undertaken a far-sighted approach to the location of new mill sites—with the problems of waste disposal properly integrated in the analytical evaluation of proposed sites.

Because the problems of sewage and industrial waste disposal require consideration in any comprehensive plan for the effective utilization of the water resources of the United States, this review of progress notes the attempts that are being made to mold a national water policy.

Need for a National Water Policy Recognized

In compliance with a Presidential Executive order, dated January 3, 1950, the President's Temporary Water Resources Policy Commission was organized to study all aspects of water use and conservation. The studies of this Commission have been published in three volumes. The first, entitled "A Water Policy for the American People," was released December 11, 1950. The second volume reports on the details of several river basin studies and the third volume (released February 5, 1951) reviews Water Resource Law. The basic report is contained in the 445 page Vol. 1 and accompanying 18 page "Summary of Recommendations of Volume One."

Prior to the appointment of the Presidential Commission, steps had been taken by the Engineers Joint Council representing five national engineering societies with a combined



WASTES from the yards of the Penna. Ry. Co. at Enola, Pa., receive chemical treatment in Link-Belt equipped plant.

membership of over 100,000 to create a National Water Policy Commission. As an initial step, an Exploratory Committee reviewed the whole field of water resources and on January 21, 1949 reported its conclusions with regard to the type of study that should be made. In November 1949, the Engineering Joint Council organized an Action Panel with respect to the development of a National Water Policy and gave it authorization to take such action as might be necessary to present to the Congress a proposal for the establishment of a Congressional Commission on National Water Policy.

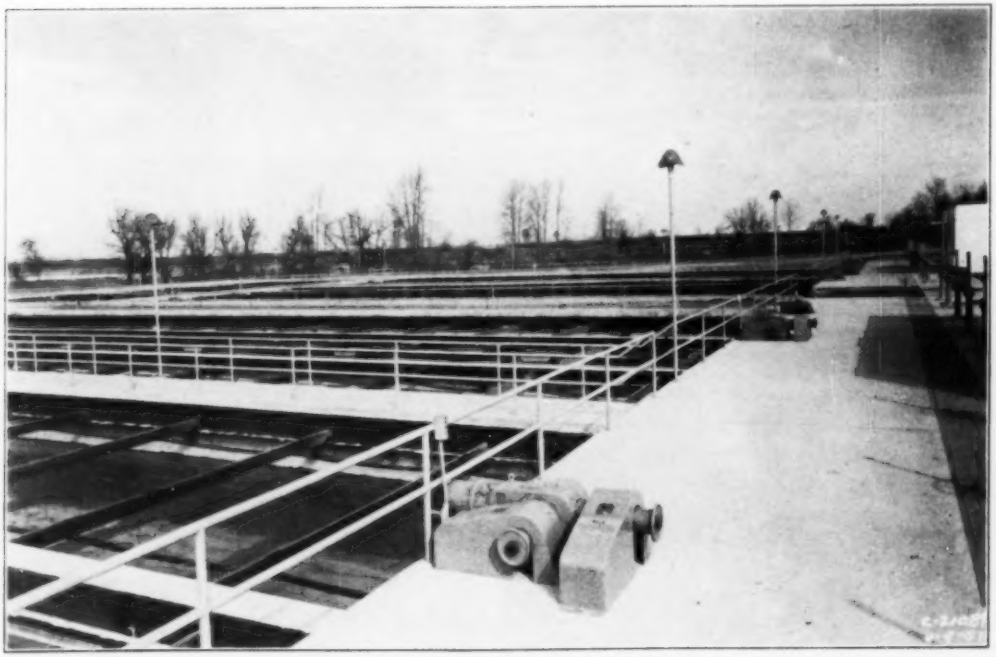
With the organization of the President's Commission, the E.J.C. Panel was invited to present its findings and recommendations to this newly organized Federal group. This invitation was accepted and some 75 leading technical experts in the water resource development field were invited to serve on voluntary Task Committees to prepare a statement of desirable water resources policy. This statement was completed and presented to the President's Commission in June 1950.

Following the release of Vol. I of the President's Commission, it was reviewed by each of the nine Task Committees of the E.J.C. Panel. In March 1951, this Panel advised E.J.C. that "while certain recommendations of the President's Commission are acceptable, the underlying philosophy of this report is so radically different from that expressed in our June 1950 statement that the two documents are in general incompatible." As a result of this disagreement with the findings of the President's Commission Report, the Engineering Joint Council, through its National Water Policy Panel, in July 1951 issued a 230 page printed report entitled "Principles of a Sound National Water Policy" for general distribution.

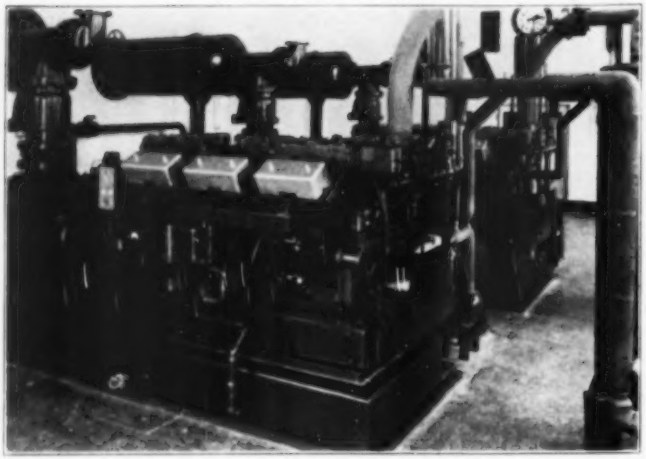
While much of the area of disagreement between these two reports lies outside the field of water quality control one recommendation of the President's Commission with regard to pollution control has been the cause of sharp disagreement. The Commission in its recommendations states in part that "The effectiveness of the 1948 Water Pollution Control Act with its dependence on local-state-federal cooperation to bring pollution under control should be thoroughly tested." It then recommends the steps that should be taken to insure a thorough test of this procedure. The final recommendation is as follows, "If this federal-state-local cooperative pollution control program fails to provide the country with clean rivers within a period of ten years, the 1948 Act should be reconsidered with a view to providing for Federal enforcement without the requirement of State consent where the polluted streams are within the jurisdiction of Congress".

The E.J.C. Task Committee on Domestic and Industrial Water Supply and Pollution, on the contrary concludes that "Pollution of water should be regulated at the lowest governmental level adequate for the particular situation. Some will be wholly local, some at State level, and some at State compact level. Federal jurisdiction and participation should be limited to the administration of existing laws; to research investigation and guidance upon which sound State laws and local regulations may be based, with as much uniformity as is consistent under the variable conditions encountered".

While it is not appropriate in a progress review to attempt an evaluation of the merits of the controversial viewpoints expressed in the quoted sections of these two reports; it is a responsibility of citizenship in a democracy to be well informed with regard to matters of governmental policy and to assist those who have responsibility in their development of sound public policies. It is anticipated that legislation dealing with matters of national water policy will be con-



PORTLAND, Ore., placed its new plant in operation. Settling tanks equipped with Chain Belt Co's. skimmers and sludge collectors.



CLIMAX gas engines drive Roots-Connersville air blowers at new plant of Boise, Idaho.

sidered by the second session of the 82nd Congress now in session.

Contemplated Legislation

HR 4882 providing for the creation of Conservation Authorities and for other purposes, was introduced by Congressman Rankin on July 19, 1951, and is presently under study by the Committee on Public Works. This bill would establish authorities similar in purpose and administration to the Tennessee Valley Authority in all the major water sheds of the United States and would transfer to the Federally appointed directors of each Authority major authority and responsibility for the planning and utilization of the national resources of each Valley Authority—including, but not limited to water resources. It is anticipated that this bill will be vigorously opposed by individuals and groups that see in it the hopes and ambitions of all who would centralize authority in the Federal Government.

Since many believe that river basin interstate compacts offer the only workable alternative to Federal water quality control, considerable interest has centered in a U. S. Supreme Court decision handed down on April 9, 1951. In a unanimous decision the Federal Court reversed the action of the West Virginia Supreme Court of Appeals and ruled that West Virginia, after having become a signatory State, was legally obligated to remain a member State of the Ohio River Valley Water Sanitation Compact. This decision has far reaching importance in its recognition of the right of a State to enter into an interstate water sanitation compact.

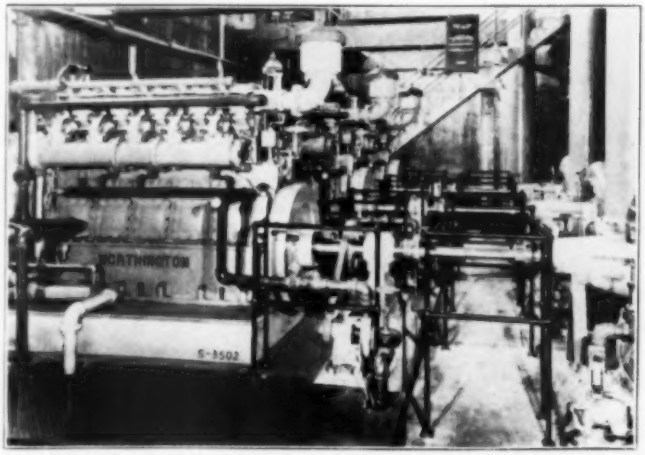
In rendering its decision, the U. S. Court held that "this compact involves a reasonable and carefully limited delegation of power to an interstate agency" and further "that adjudication of conflicting State interests affecting stream pollution does not rest upon the law of a particular State. A compact such as this is, after all, a wholly legal document". By its action the U. S. Supreme Court rejected the contention that the delegation of police powers by a State to a compact authority was contrary to the principles of constitutional law and gave its approval to the delegation of such authority. The Supreme Court expressed the further opinion that the interpretation of a compact between States rested ultimately with that Court and rejected the suggestion "that an agreement solemnly entered into between States by those who alone have political authority to speak for a State can be unilaterally nullified or given final meaning by an organ of one of the contracting States." This decision should do much to strengthen the position of those who see in the interstate compact a governmental administrative procedure that will provide for all the coordination between States that will be necessary for effective basin wide water pollution control programs.

In this connection, it is of interest to note that since the U. S. Court decision the states of Vermont and New Hampshire became signatory States of the New England Interstate Water Pollution Control Compact. States signatory to the pact earlier include Massachusetts, Connecticut, Rhode Island, and New York. Decision by Maine to join in the compact is pending.

Plant Construction Index of Progress

Regardless of the methodology of governmental supervision and administrative technique, one very real measure of progress in sewage and industrial waste disposal is to be found in the number of treatment plants that are being planned or placed under construction. These provide the tangible evidence that progress is indeed being made, despite the retarding influence of a national economy that is dividing its productive potential between consumer goods, internal improvements and military demands.

One of the outstanding achievements of the year was the placing in operation on March 19, 1951 of the new high rate activated sludge plant at Los Angeles. This plant is designed to handle an average dry



WORTHINGTON gas engines drive pumps of same company at Oklahoma City's new Southside Treatment Works.

weather flow of 245 m.g.d. and a maximum of 420 m.g.d. The sludge will be digested, de-watered on vacuum filters and heat dried for fertilizer. The effluent after disinfection with chlorine will be discharged through a submarine outfall one mile off shore. With the disappearance of bacterial pollution, the quarantine of the Santa Monica beaches was lifted by the California State Board of Health on July 24, 1951.

In the San Francisco metropolitan area the East Bay municipalities are progressing with a sewage disposal project that will serve the cities of Oakland, Berkeley, Alameda, Piedmont, Albany and Emeryville, with the construction now more than ninety percent complete. In San Francisco proper, two plants are nearing completion. The North Point Plant will have a capacity of 63 m.g.d. and the Southeast Plant a capacity of 30 m.g.d. Both plants provide preaeration, sedimentation and sludge digestion, dewatering on vacuum filters with flash drying.

Plans are under way for sewage treatment at San Jose, California, where primary treatment will be followed by oxidation ponds covering 1750 acres.

Seattle and Tacoma are finding the disposal of sewage through deep water outlets generally unsatisfactory and are making plans for appropriate types of primary treatment and chlorination. Treatment facilities have been completed and are now in operation at Portland, Oregon. (Ed. Note: The Portland plant, with its unique features is shortly to be described in an article in this magazine.)

On the east coast good progress is being made on New York City's major sewage treatment project with 1959 now set as a completion date for the eighteen plants that will serve as many drainage areas. Thirteen of these plants were in service in 1950 with the Owl's Head high rate activated sludge treatment plant scheduled to go into operation in early 1952. The 120 m.g.d. Hunt's Point Plant, put under construction in 1951, is expected to be placed in operation during 1952. The Rockaway plant will be the next to be completed. These plants, when in operation, will add approximately 265 m.g.d. to the 450 m.g.d. capacity of the existing 13 plants. This will provide treatment facilities for approximately seventy percent of the city's sewage flow.

The degree of treatment varies with the requirements of the several sewage disposal sites. In 1950, 290 m.g.d. of the average daily flow of 391 m.g.d. received at the several plants was treated by the activated sludge process. Seventy-seven m.g.d. received treatment by sedimentation with 47 m.g.d. of this amount receiving additional chemical precipitation during the summer. Twenty-four m.g.d. received screening treatment only. Chlorination was provided for 126 m.g.d. for beach protection during the bathing season. The Wards Island activated sludge plant has been modified to permit either step aeration or high rate activation with its capacity increased from the original design of 180 m.g.d. to 240 m.g.d. With the high rate activated sludge process in successful operation for several years at the Jamaica plant, this process is being or will be used at the Bowery Bay, 26th Ward, Hunts Point, and Rockaway, as well as at Owl's Head.

The pollution of Boston Harbor, as well as that of the lower Charles River, will be controlled with the completion of the present construction program which will combine the North and South Metropolitan Sewerage Districts with the Boston Main Drainage District in joint works for the collection and disposal of sewage. The Charles River Basin is protected by the construction of new relief sewers on both sides and a detention basin on the south side for the chlorination of occasional storm water overflows. Treatment facilities, under construction at Deer Island, were scheduled for completion in 1951.

In Florida, the city of Tampa is completing a construction program including intercepting sewers, pumping stations with treatment by sedimentation and chlorination for 36 m.g.d. at a cost of approximately $9,500,000 to be financed wholly through sewer service charges.

Miami is preparing plans for a high rate activated sludge plant to be located on Virginia Key. The project will involve the construction of interceptors, pumping stations, force mains and an ocean outfall, in addition to the treatment plant.

Other east coast improvements include the major sewage treatment program of Philadelphia, extensions to the sludge handling facilities of the plants at Washington, D.C., and Baltimore, Maryland, and the near completion of a 27 m.g.d. activated sludge treatment by District No. 2 in Nassau County, Long Island, New York.

PHILADELPHIA'S new 125 mgd. Northeast Treatment Plant, the first of three treatment plants, went into operation in 1951.

YEOMAN'S "Spiraflo" clarifier at Bartow, Fla.

The upper Ohio River will be greatly improved with the completion of works now in the planning stage at Pittsburgh, Pennsylvania.

The Allegheny County Sanitary Authority is preparing plans for treatment facilities for the 150 m.g.d. sewage flow from the cities served by this Authority. Following a year's pilot plant study, this plant is being designed to concentrate the sludge in a period of 5 days by a method of flotation. Pilot plant studies indicate that preheated sludge, when held at 95 degrees Fahrenheit for 5 days, will float to the top of the holding tank with a solid content of from 16 percent to 24 percent. It is reported that this sludge can be further dewatered on a vacuum filter without prior chemical conditioning, or it can be incinerated as is. The sludge will be mixed with fuel and incinerated. This method of sludge concentration is being called the Laboon Process in recognition of the developmental work of Mr. John F. Laboon, Chairman of the Authority.

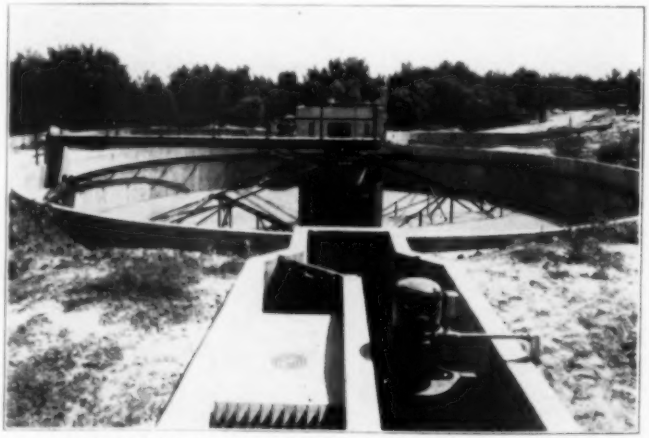
Down river from Pittsburgh, the city of Cincinnati, fully appreciative of the importance of a clean-up of the Ohio River, is progressing rapidly in the development of its sewage disposal program. On December 28, 1950, it awarded a contract for the construction of the Little Miami Sewage Works at a cost of $4,186,000. This plant will be of the flocculation-chemical type with sludge digestion, elutriation, vacuum filtration and incineration. The plant is designed to meet the Ohio River Valley Water Sanitation Commission Standard of effluent quality for sewage discharged into the Cincinnati pool of the Ohio River. These standards require the substantially complete removal of settleable solids and the removal of not less than 45 percent of the total suspended solids. B.O.D.'s are to be reduced not less than 65 percent except that when the flow of the river is such that 4 p.p.m. oxygen can be maintained at the minimum point on the oxygen sag curve below Cincinnati, a lesser degree of B.O.D. reduction may be permitted, but in no case may it go below 35 percent. The Little Miami plant of Cincinnati is the first of four plants that will be required in the over-all sewage treatment project, estimated to cost approximately $30,000,000 and to take ten years to complete.

While far from complete, this review of some of the major construction projects planned to reduce the pollutional load on the inland and coastal waters is evidence that progress is indeed being made. Industry has also been making an outstanding contribution to pollution abatement through the construction of 375 waste treatment plants reported from 28 states in 1950 by "Wastes Engineering."

Research and Plant Scale Studies

Research during the year has been extensive and as varied as the nature of the problems that confront industry, public health officials, and designing engineers.

While some research may properly be considered basic in its intent and undertaken without a need for direct application, the immediate demands of specific situations usually require that research be directed first to the solution of a definite problem and second, and somewhat incidentally, it may contribute to a better understanding of basic concepts. It is functionally a field of applied research. The extent of research and development in this field is evidenced by the annual reviews of the Research Committee of the Federation of Sewage and Industrial Wastes Associations. Starting in 1933, this committee to date has reported on over 3,000 separate items. The May 1951 issue of "Sewage and Industrial Wastes Journal" includes the report of Dr. Rudolf's research committee and its review of 661 publications under the title "A Critical Review of the Literature of 1950 on Sewage, Waste Treatment and Water Pollution." A second analysis of progress in development, as well as research, was provided by the Committee on Sewerage and Sewage Treatment of the Sanitary Engineering Division, A.S.C.E. in its report entitled "Advances in Sewage Treatment in the Period from January 1, 1950 to October 1, 1951,"



INFILCO'S "Griductor" and clarifier mechanism at McCook, Neb.

presented at the Annual Meeting of the Society in New York, October 23, 1951, by the Committee chairman, Mr. Langdon Pearce (as yet unpublished).

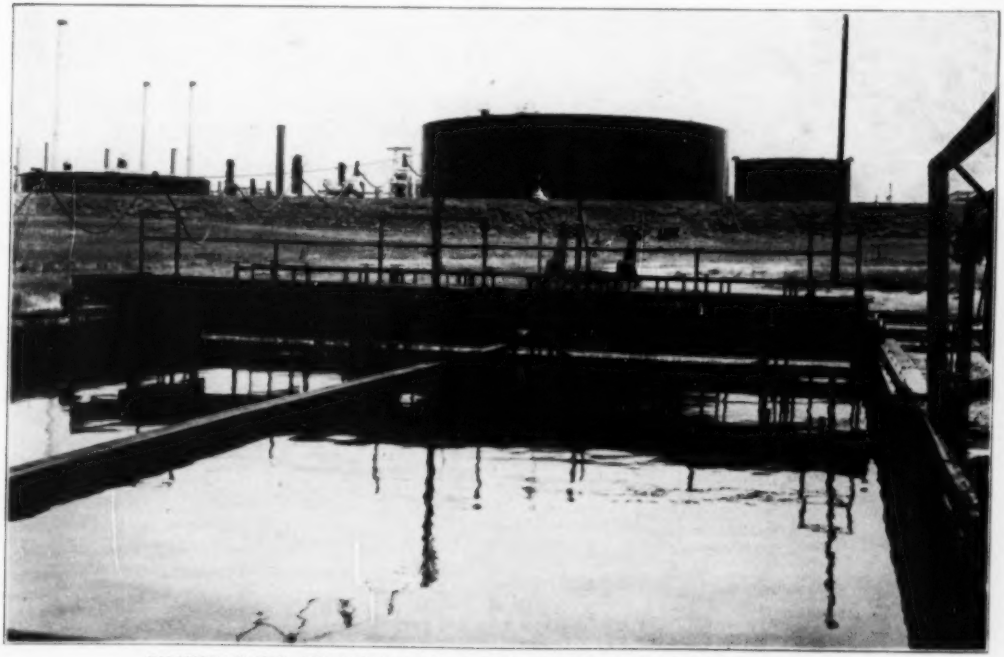
Although concurrent, the Federation Review of Literature and the Civil Engineering Report on Advances in Sewage Treatment are sufficiently divergent in approach to give perspective and depth to a panoramic view of present progress and development.

Industry has been largely responsible for recent increases in research interest. Laboratories are actively developing new techniques for the determination of minute quantities of objectionable substance associated with the many types of industrial waste. Standard tests suitable for the analysis of municipal sewage wastes are being re-evaluated and modified for the measurement of industrial wastes. The non-biological chemical oxygen consumed test is being recognized as a useful yardstick for measuring wastes under conditions not suitable for bacterial activity. The Sub-committee on Toxicity, of the Research Committee of the Federation published (Sewage and Industrial Wastes, November 1951) a very important and basic study on the "Bioassay Methods for the Evaluation of Acute Toxicity of Industrial Wastes to Fish." This represents a study made possible through a research grant from the National Institute of Health and conducted with the coordination of Dr. W. D. Hatfield.

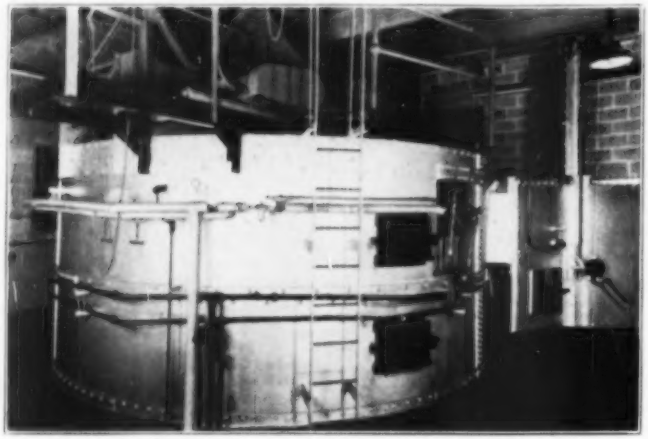
A basic study of the nutritional requirements in the biological stabilization of industrial wastes, also supported by a research grant from N.I.H., was presented by Helmers, Greenberg and Sawyer at the 1951 Purdue Industrial Waste Conference. Three industrial wastes having nutritional deficiencies—cotton kiering waste, rag rope pulping waste and brewery waste—were mixed in varying proportions with domestic sewage for activated sludge treatment. It was found that domestic sewage in sufficient quantity would supply the nutritional requirements for biological stabilization of these types of industrial wastes. Also, high industrial waste loadings that result in nutritional deficiencies tend to impair settling and de-watering characteristics of activated sludge. The study of nutritional deficiencies in industrial and mixed sewages recognizes a basic biological concept that may clarify some operational difficulties and increase organic stabilization.

The treatment and disposal of radioactive wastes has been studied principally by laboratories working with the eight subcommittees on waste disposal and decontamination of the National Committee on Radiation Protection. Two divisions of the Oak Ridge National Laboratory—the Chemical Technology and the Health Physics—are responsible for the treatment of radio-active wastes at that laboratory. Dr. Conrad P. Straub, U.S.P.H.S. Sanitary Engineer assigned to the Health Physics Division, reviewed recent developments in this field in a paper presented at the A.A.A.S. meeting in Cleveland, December 26-30, 1950.

Various methods of concentration of radioactive materials are reviewed including sand filtration where the removal effect is found to be somewhat selective (P^{32} being retained but not P^{33}). Under certain circumstances cationic resin exchangers were found to be effective. The absorptive action of natural soils and clays has effected removals of radioisotopes up to 85 percent. Biological processes were studied by Ruchhoff, and by Straub with excellent concentrations being obtained on aerated activated sludge. Regardless of the method of concentration used, the residue remains for disposal. Straub observes "All that can be accomplished is to concentrate the radioactive fraction into a smaller volume to permit disposal as a slurry



REFINERY WASTES of Shell Oil Co. at Houston, Tex., pass through oil and sludge separating tanks equipped with Hardinge skimmers and sludge collectors.



BRIDGEPORT, Conn., has installed a Nichol's multi-hearth sludge incinerator.

or sludge." Incineration of this sludge with proper protection against volatile gases and fly ash will produce further reduction. The residue must eventually be "buried in controlled areas, or stored for decay or future recovery." Dr. Straub's report was based on work done at the Oak Ridge Laboratory. The development of radioisotopes as biologic tracers provides the research laboratory with a new and useful technique for the furthering of certain basic studies.

An N.I.H. supported study of biochemical oxidation by direct methods has been reported by Heukelekian and Gellman, (December Sewage and Industrial Wastes). Through the use of both the Sierp and Warburg apparatus, extensive studies have been made utilizing oxygen requirement to measure the factors affecting the oxidation of wastes in a way similar to studies that measure these factors in terms of gas production.

The factors considered in these studies were:

1. Effect of pH value. It was found that an initial pH adjustment to a value between pH 6 and pH 8 prevented interference with oxidation.

2. Effect of nutrient addition. Findings indicate that to prevent nitrogen deficiency from limiting the rate and extent of wastes oxidation that a ratio of B.O.D. to a biologically available source of nitrogen of between 17 and 22 to one should be maintained.

3. Effect of substrate concentration. It was found that the reaction velocity constant (k) for the oxidation of settled sewage, as determined from oxygen added, was the same as for the standard dilution procedure. Total oxygen demands by direct methods are somewhat higher.

4. Effect of volume and source of sewage seed. The source of sewage used for seeding appeared to have no effect when used for seeding dextrose peptone substrate. Volume of seeding has some effect on the rate of oxidation at the onset of the test, an effect that is soon overcome with normal increase in biological flora. By adaptation, seed material can be developed that will oxidize without lag phenol concentrations as high as 2,000 ppm.—unadapted seed will show some lag—the lag period increasing with the phenol concentration.

Return of Sewage Solids to the Land

In a paper of the Journal series, New Jersey Agricultural Experiment Station, Rutgers University, Dr. William Rudolfs (with Lloyd L. Falk and Robert A. Ragotzkie) has reported on the contamination of vegetables grown in polluted soil, a study conducted under a project contract with the U. S. Army Quartermaster General.

The study was for the purpose of determining:

1. The factors involved in the contamination of vegetables grown in polluted soil.

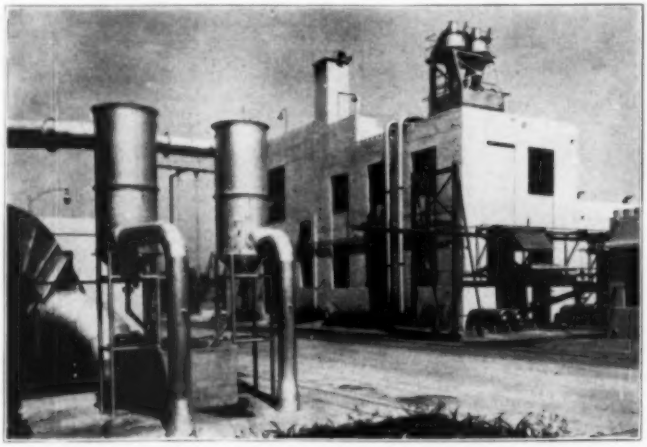
2. A survival study of enteric bacterial and animal pathogenic or parasitic organisms.

3. Methods of cleaning contaminated vegetables.

From the study, based on the examination of tomatoes, lettuce, spinach, and carrots raised under controlled pollution conditions, the general conclusion derived was that night soil and sewage effluents could be used with safety under strict controls, and that a sufficient length of time between the last application of the polluted fertilizer and the harvesting of the crop is an essential safeguard. The only safe method found for the de-contamination of bacterial, amoebic, and helminthic organisms was pasteurization at 140°F. for five minutes.

Dr. Rudolf's study recognizes the essential need for the utilization of night soil as a fertilizer in the economy of densely populated sections of the world where maximum food production is a fundamental requirement for survival. The establishing of safe practices for the full utilization of the fertilizer value of sewage and garbage wastes is very important to sanitary engineers stationed for one purpose or another in countries where tradition and practice do not recognize the aesthetic objections that restrict this practice where soil resources are more abundant.

An increasing interest in composting organic refuse to produce humus for soil conditioning is noted. A comprehensive review of the several methods of composting used in various parts of the world is provided in "Composting for the Disposal of Organic Refuse"—Technical Bulletin No. 1, Sanitary Engineering Project,



GROWTH—San Diego, Calif., had to triple its Raymond flash sludge drying and incineration system in plant enlargement program.

University of California. A lack of interest in composting in the United States has produced a like lack of technical information regarding methods that may in time provide a valuable source of needed soil conditioner. However, there is a continuing interest in sludge processing for fertilizer use. Heat dried activated sludge has been sold by Milwaukee, Houston, and Chicago for some years. In June, Los Angeles entered into a 10 year contract to sell a 3% nitrogen content digested and heat dried activated sludge at $10.16 per ton at the plant. San Diego sells 2.24% nitrogen content digested heat dried sludge for $7.00 per ton.

Uniform Standards in Sewage Works Design

An attempt is being made by the state public health engineers of two regional areas to secure a mutual agreement with regard to certain fundamental design requirements for sewage treatment facilities. After a year of preliminary study by consulting and other interested engineers, a revised version of "Tentative Standards for Sewage Works" was made available in January 1951 by a joint committee on Development of Uniform Standards for Sewage Works, representing the Upper Mississippi River Board of Public Health Engineers and the Great Lakes Board of Public Health Engineers and covering the states of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, and Wisconsin.

Major headings in these standards include: submission of plans; design and construction of sewers; design of lift stations; and the design of the component parts of a treatment plant.

During the year the Pollution Control Council, Pacific Northwest Basin; representing the State Pollution Control agencies of Washington, Oregon, Idaho, and Montana, the Province of British Columbia, Territory of Alaska, and the Public Health Engineering Division, Department of National Health and Welfare, Canada, and the Division of Water Pollution Control, U. S. Public Health Service, also adopted a code of uniform design standards for sewer systems and sewage treatment works. It is proposed that the "Sewage Works Design Standards" compiled by this committee be used on a trial basis for a period of time before being adopted by the several governmental bodies represented on the Council.

The coverage of this code is similar to that of the Upper Mississippi—Great Lakes "Tentative Standards" and represents a desire on the part of those administratively responsible for the review of plans and specifications to secure coordination and uniformity in regulatory requirements.

While codes are necessary to guide the judgment of the non-technical skilled worker, it would be unfortunate if professional engineers should find themselves restricted in their judgment or prevented from applying inventiveness by the self-imposition of preconceived standards. Unless constantly revised, regulatory standards and codes tend to perpetuate obsolescence and to discourage further research in the areas covered by them. Properly used in a non-regulatory way, standards can provide a very helpful support for the reviewing engineer and it is presumed that these codes will be so interpreted.

Chlorine in Sewage and Waste Treatment

A comprehensive review of the use of chlorine in the treatment of sewage and industrial wastes has been provided by the Federation Committee on Sewage and Industrial Wastes Practice through its sub-committee on Chlorination of Sewage. This committee studied more than 2,500 literature references in gathering both theoretical and application guidance material in the preparation of an 84 page Manual of Practice. (Federation of Sewage and Industrial Wastes Associations Manual of Practice No. 4.) This is one of a series of reports or manuals that are being prepared by this committee in its review of technical research and practice—not as a prescribed "standard" practices "which might tend to discourage the rapid technological advancement that has characterized the art and science of wastes treatment and disposal in the past" (quoted from introduction to Manual No. 4) but as a source book for information and guidance in the solution of technical problems. The Manual includes a bibliography of over 350 selected references and reviews of chlorination practice in the treatment and disposal of sewage and industrial wastes from the earliest

SAN DIEGO, Calif., has had to almost triple size of ten-year old plant to keep abreast. On right and left are the Currie "Claerators," which provide aeration in outside ring and clarification in center of tank.

ADVANCEMENT—1951—one of the many short courses held for sewage works operators. This one was at the Univ. of Wisc.

known applications to the present. Its aim has been to provide factual evidence concerning the useful applications of chlorine for the various purposes associated with waste treatment and disposal. Through their acceptance and use of this manual, which represents the work of this subcommittee since its organization in 1945, research workers, plant operation personnel, consulting engineers, and manufacturers will show their appreciation of the contributions made by the members of the committee in producing this manual.

Water Quality Standards and Objectives

A review of progress would not be complete without a brief look at the water quality objectives that are being established for the rivers, lakes, and coastal waters that must eventually receive the used water of cities and industries. These objectives may be defined by limitations imposed on the quantity and quality of pollutional material discharged or in terms of the concentration of pollutants in the receiving body of water. Water quality objectives should be consistent with the requirements imposed by the anticipated usage of the receiving waters. Also, the laboratory yardsticks that are used to measure water quality need to be carefully selected to cover all the properties of the pollutant substance that may detract from the quality of the water for further use. The standards that measure the biological disintegration and mineralization of organic refuse that normally goes forward in nature, and which are only expedited under control in municipal sewage treatment plants, obviously fail to measure the total pollution effects of mixed industrial wastes. While we know that nature continues the process of destroying organic residue and that the receiving body of water has a capacity to biologically assimilate organic waste, we sometimes fail to appreciate that untreatable inorganic wastes are only diluted.

As we ask for public recognition and endorsement of the work that is being carried forward in attempts to maintain reasonable water quality standards, we also have a responsibility to present to the public a factual picture of what can be achieved. We dare not ask support for an attempt to accomplish the impossible or even the impractical. As an end product of our efforts, human welfare must ultimately be served. Hedgepeth in

PALM SPRINGS, Calif. converts primary clarifier to Process Engr's. "Oxidator," providing combination of aeration and clarification in single unit.

the Sept. 1951 issue of *Water & Sewage Works* has justifiably expressed the thought that we are "constantly confronted with the necessity of balancing the economic health of a community against th aquatic health of a stream."

If an industry is producing an untreatable waste in a quantity that cannot be disposed of through dilution without noticably impairing the quality of the receiving stream—that industry may be confronted with the alternative of either shutting down, changing the manufacturing process or moving to a new location where diluting waters in larger volume are available—or the public must accept, willy-nilly, a further impairment of the quality of the receiving water. The Virginia Supreme Court of Appeals very properly observed that "The aesthetic and recreational features involved in the pollution problem are important but the opportunity to make a living may be even more so." (Reference by Hedgepeth).

Pollution Problem a Future Factor in Plant Location

The availability of adequate water resources, not only for use but also for the acceptable disposal by dilution of the non-treatable residues of industrial waste, is now being recognized as a very important factor in determining

RICHMOND, Ind., builds new sewers of "bottle-tight" construction with asbestos-cement pipe.

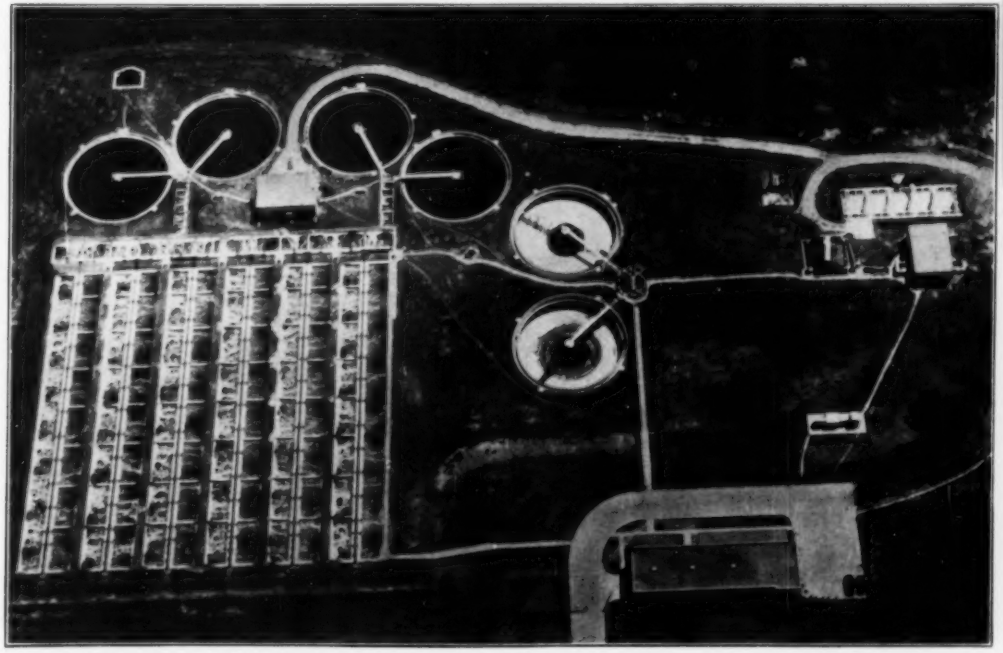
where certain types of industrial development may or may not take place.

A factual approach to this problem is evidenced in the reports of the Board of Technical Advisors, International Joint Commission in dealing with the industrial waste problems of the Lake Huron-Lake Erie section of the International Boundary waters. These reports recognize that adverse conditions can be produced in the receiving waters by the presence in concentrations above established standards of any, or a combination of several, of the following pollutants:

1. Excessive bacterial, physical or chemical contamination.
2. Unnatural deposits in the stream interfering with navigation, fish, and wild life, bathing, recreation or destruction of aesthetic values.
3. Toxic substances and materials imparting objectionable tastes and odors to waters used for domestic or industrial purposes.
4. Floating materials including oils, grease, garbage, sewage solids, or other refuse.

This approach recognizes that the "reasonable use" of a stream results in some impairment of the natural quality of the water and that this impairment must of necessity take place incident to the utilization of this essential natural resource. It does require, however, that pollutant residuals be controlled to a level that will prevent such impairment from interfering with other normal uses. It further recognizes that it is not only the condition at the present that must be considered but that the development of new industries and processes must not destroy values established on the basis of present water quality standards.

Looking to the future we conclude that despite the progress made in 1951, there are many unsolved problems that will make future years equally significant.



HOUSTON, Tex., suffering never ending growing pains, added the new Simms Bayou Plant to its string of plants.

A.W.W.A. Board Actions

New Award Named for Jordan; First Recipient Abel Wolman. Cunningham, New Vice-President.

Chas. A. Capen
(Pres. Elect)

M. B. Cunningham
(New Vice-Pres.)

A. E. Berry
(The President)

W. W. Brush
(Treasurer)

AWWA's Brass—New and Old

THE AM. WATER WORKS ASSN. Board of Directors held its annual meeting in New York City on Jan. 13-15. Thirty-nine of the forty member board were in attendance.

The Nominating Committee, composed of all members of the Board representing the various sections, chose the following as officers for the year 1952-'53. Those nominated become elected automatically on March 1st, unless other names are placed in nomination by the membership at large. Those elected take office at the close of the Kansas City Convention May 9, 1952.

For President—
Chas. H. Capen, Chief Engr.,
North Jersey Water Supply Comm.
Wanaque, N.J.

For Vice-President—
Morrison B. Cunningham,
Supt. & Engr.
Dept. of Water and Sewerage
Oklahoma City, Okla.

For Treasurer—
Wm. W. Brush, Editor,
"Water Works Engineering"
New York City

New Honorary Members

The Board elevated the following to Honorary Membership:

NORMAN JOSEPH HOWARD, Director of Water Purification, Toronto, Ont. Member of Association since 1920; Chairman Canadian Section 1931-32; Director Canadian Section 1934-37; Vice-President of Association 1940; President 1941; Fuller Award 1943. Internationally distinguished for his research in and practice of water purification. For many years the unselfish medical counsellor of a group of people for whom professional medical services were not available.

HOWARD SCOTT MORSE, Retired General Manager, Indianapolis Water Co., Indianapolis, Ind. Member of Association since 1925; Chairman Indiana Section 1926-27; Director, Indiana Section 1930-31, 1933-36. A distinguished leader, who combined an understanding of the public's interest in water service with an ability to inspire the personnel under his direction into an effective public utility.

NATHAN THOMAS VEATCH, Senior Partner, Black and Veatch, Kansas City, Mo.; Member of the Association since 1915; Chairman Missouri Valley Section 1937-38; Director Missouri Valley Section 1941-44; Vice President of Association 1947; President 1948; Fuller Award 1951. The able leader of an active engineering organization devoted to the improvement of water supply service, always willing when called upon to serve the people through application of his professional knowledge to public problems.

New Award for Achievement to Wolman

A new award has been established in the Association. It is not an award to be voted each year, but is intended for presentation occasionally and denoting some outstanding or distinguished service *outside the line of duty*, and in the form of a public service, rendered by the member upon which the new honor is to be conferred.

This award, known only as the "Achievement Award" when recommended to the Board by the General Policy Committee during the 1951 Convention, at which time it was established, has now been given ever greater meaning through action taken by the Board on Jan. 13th.

In recognition of what can only be described as "superior service" rendered by Harry E. Jordan to A.W.W.A. during the fifteen years which he has been secretary of the Association, and during which so much has in consequence been achieved in building up the Association and its service to the members (and, therefore, indirectly to the benefit of the general public) it was recommended to the Board by the General Policy Committee, on which this writer has the privilege of serving, that the new award be named—

THE HARRY E. JORDAN ACHIEVEMENT AWARD

The Board voted unanimously to adopt this name for the new award in recognition of the achievements of Secretary Jordan *in the line of duty*.

Having appropriately re-named the new award, the General Policy Committee offered to the Board the name of Abel Wolman as its unanimous choice to be honored as the first recipient of "The Harry E. Jordan Achievement Award." A unanimous vote of approbation by the 39 Board members, employing the secret ballot, completes the story of an award well named, and the choice of a recipient which does further honor to the Award.

The citation reads:

ABEL WOLMAN. Endowed with a brilliant mind, indoctrinated with the highest ethical principles by his devoted parents; trained in the routines of analytical and objective thinking by his teachers; matured into an inspiring guide of those who follow his leadership—Abel Wolman, a first generation citizen, is a living testament of the American way.

Entering the service of the people of Maryland as an Engineer of the State Department of Health upon his graduation from Johns Hopkins, he became Chief Engineer, following the retirement of Robert

N. J. Howard
Toronto

Elected Honorary Members
H. S. Morse
Indianapolis

N. T. Veatch
Kansas City

Morse in 1922. He was Editor of the first American Water Works Association Manual of Water Works Practice in 1924, and from 1921 to 1937 edited the Journal of the Association. Since 1937 he has been Professor of Sanitary Engineering at Johns Hopkins University.

He has served the State of Maryland upon various boards and commissions concerned with public works and planning. He has been called upon as consultant to many cities faced with difficult water supply or sewage disposal problems.

He was chairman of the Water Resources Group, acting under the National Resources Committee, and in that capacity advised the Congress and the President constructively in matters of policy.

Since World War II, he has served the World Health Organization as chairman of its Committee on Sanitary Engineering. He is consultant to the Atomic Energy Commission in the field of Sanitary Engineering.

Within the past year, he masterfully performed the difficult task of acting as Coordinator of the Engineers Joint Council's Water Panel in development of a clearly stated series of recommendations concerning a National Water Resources Development Policy.

Since the beginnings of the Republic of Israel he has advised its leaders in their planning of water resources developments. He spent the summer of 1950 on a voluntary tour of study and advice to this new nation in its efforts to restore that land to its long lost productive level.

For the last named and the numerous other services, beyond the line of duty and in the form of public service, Abel Wolman deservedly receives this new token of distinction from A.W.W.A.

Other Awards and Prizes

The DIVEN MEDAL, named for the Association's first secretary, is voted that member who has rendered an outstanding service to the Association. For this type of service the 1951 Diven Medal was voted to—

EARNEST W. WHITLOCK, in recognition of his untiring efforts and effective leadership in coordinating the divergent views of his Committee on Reinforced Concrete Pipe, and the development of Standard Specifications for Concrete Pressure Pipe, thus contributing to the advancement of sound water works construction practices.

The GOODELL PRIZE, named for the first editor of the Association's Journal, is awarded each year to the member who has made the most notable contribution to the science or practice of waterworks development, as recorded in the form of a paper or report published in the Association's Journal. The Goodell Prize for 1951 was voted to—

JOSEPH M. SANCHIS and JOHN C. MERRELL JR. for their paper entitled "Diatomaceous Earth Filtration" which was published in the July 1951 issue of the Journal beginning on page 475. The paper presents an unbiased appraisal of diatomaceous earth filtration and the possibilities of its application to a large water supply system. The long range importance of this subject is recognized and is receiving considerable attention throughout the country. The highly competent contribution that the paper by Messrs. Sanchis and Merrell has made in this field is of marked value to the water works field.

Section Cup Winners

THE HILL CUP for membership growth during the year 1951 will again be awarded to the Kansas Section which has a point score of 49,950. The Indiana Section was second in the competition with a point score of 36,416; the Florida Section third with a point score of 32,300.

Honored
Principals in the New Achievement Award
Harry E. Jordan *Abel Wolman*

THE HENSHAW CUP for the year 1951 will be awarded to the Cuban Section which had 80.0 per cent of its members in attendance at its annual meeting. The West Virginia Section was second with 58.5 per cent of its members present, and the Alabama-Mississippi Section third with a score of 57.7 per cent.

THE OLD OAKEN BUCKET will again be awarded to the 989 member California Section. This award annually is given to the Section having the greatest number of members. The New York Section stands second with 699 and the Southwest Section third with 670 members. The Old Oaken Bucket, put into competition in 1939, has been won by the California Section continuously since that time.

Board Recorded Its Satisfaction With Water Resources Div. of N.P.A.

The Board, together with a group of manufacturers of water and sewage works equipment, gave consideration to the conditions in the water works field as affected by the current defense program and the resulting restriction upon civilian activities. The following resolution was unanimously approved:

The Board of Directors of the American Water Works Association convened in the Annual Meeting in New York City records its satisfaction in the establishment of the Division of Water Resources in the National Production Authority, as requested by this Board and by the membership of this Association in Convention in Miami in May 1951.

The Board records its deep appreciation of the work done by Harvey Howe in organizing the staff and program for the Water Resources Division. His services were invaluable.

This Board also records its appreciation for the continuing understanding and efficient operation of the Water Resources Division under its present Director, Gerald E. Arnold and his staff, and assures the Division of its cooperation and support.

Recommendations of Committees on Administration and W.W. Practices

Through its chairman, W. R. LaDue, the Committee on Water Works Administration recommended the following, which the Board approved.

(1) Direct the A.W.W.A. staff to develop information concerning the powers of unincorporated population groups to build water works and issue bonds to fund such works in the various states.

(2) Authorize the organization of Task Groups to develop Safety Manuals to cover the functional division within water works properties.

Through its chairman, L. R. Howson, the Water Works Practice Committee recommended the following, which the Board approved.

(1) A special committee (L. R. Howson, W. V. Weir, M. C. Smith) to review the proposed specifications for Mechanical Joint Cast-Iron Pipe and report promptly their concurrence or objections.

(2) A joint session of the Water Works Practice Committee and the Working Committee for the purpose of evaluating the pending report on Asbestos-Cement Pipe Specifications.

(3) Emergency modifications of specifications for water meters after the required two weeks waiting time. These modifications derive from the restrictions upon use of copper promulgated by NPA.

Question Raised Concerning Fluoridation Policy

A resolution concerning A.W.W.A.'s policy on fluoridation and the need for further clarification of that policy, was received from the officers of the New Jersey Section. The Board referred the matter to the General Policy Committee for study and report at the Kansas City Convention.

Apparently New Jersey water works managers have the feeling that A.W.W.A. is leaning too much in the direction of encouraging the advancement of water fluoridation, which is becoming embarrassing to those who are not in sympathy with fluoride treatment.

National Water Resources Policy As Related to Stream Pollution*

by L. R. HOWSON, *Alvord, Burdick & Howson, Cons. Engrs., Chicago, Ill.*

IT would appear that in defining the relationship between National Water Resources policy and stream pollution, several questions should be answered:

1. How serious is stream pollution?
2. Are present controls over stream pollution adequate and if not, why not?
3. At what governmental level should stream pollution be controlled?
4. And at whose expense should pollution reduction be made?

How Serious is Stream Pollution?

Undoubtedly stream pollution exists and to an important extent. In the recent report of the President's National Water Policy Commission, reference is made to the pollution conditions disclosed by the U.S. Public Health Service in its survey of eleven major river valleys said to be selected to be representative over the country as a whole. From this review the Commission concluded:

1. Even though not all streams are polluted, our major streams are gravely affected and the problem is nationwide.

2. Pollution is a factor that already affects or eventually will affect all water resources development, whether it be for flood control, irrigation, hydroelectric power, municipal and industrial use, or recreation.

This survey covered 4,409 municipalities and 3,413 industrial plants. Forty-three per cent of the cities and 57 per cent of the industries were discharging untreated wastes, and 800 of the treatment plants were overloaded or inadequate.

But let us look at the other side of the picture. . . .

Sewage and waste disposal really had their inception about the turn of the century. By 1920, there were 1,000 municipal sewage treatment plants in the United States handling wastes from approximately 10,000,000 people; 18 per cent of the urban population then had some form of sewage treatment. Fig. 1 shows the growth in U.S. urban population and that part of it provided with sewage treatment facilities.

The number of treatment plants increased to approximately 2,400 in the next decade and 18 million, or more than 35 per cent of the urban population was then tributary to sewage treatment plants.

In the next two decades, which embraced the longest depression in our history and World War II, the number of sewage plants more than doubled and the population served, tripled. As of 1950, approximately 60 million people were tributary to more than 6,700 sewage treatment plants and 65 per cent of the urban population of the United States had some form of waste treatment. Fig. 2 shows the growth in the number of municipal waste treatment plants and the percentage of urban population having waste treatment.

Assuming, for illustration, that the waste treatment plants have an overall B.O.D. removal efficiency of 66 2/3 per cent, that is equivalent to saying that 40 million people in the U.S. are now receiving complete sewage treatment.

The accelerated rate of sewage treatment is reflected in the following figures:

Decade	Additional Population Having Sewage Treatment
Prior to 1900	3,000,000
1900-1910	5,000,000
1910-1920	5,500,000
1920-1930	8,500,000
1930-1940	19,000,000
1940-1950	23,000,000

If this accelerated rate should continue, another couple of decades would complete the job. Truly much has been accomplished.

The extent to which sewage treatment has progressed is, however, not universal, and entire rivers, like the Ohio, the Connecticut and others, have had substantially no reduction in pollution load during this period when in the U.S. as a whole progress has been rapid. On these streams, pollution is still serious and must be corrected.

It should also be pointed out that due to the continually increasing percentage of people that live in cities, as well as the over-all population growth, the urban population has doubled in the last 35 years and is currently increasing at the rate of approximately 1,500,000 per year. New facilities will, therefore, be needed for this growth.

Also, as the population density increases the degree of treatment must be stepped up.

The sum of these two requirements illustrates the continuing need for additional treatment facilities, a fact which has been reflected in water works expenditures over the last quarter century increasing at a rate 2.5 times as fast as the population.

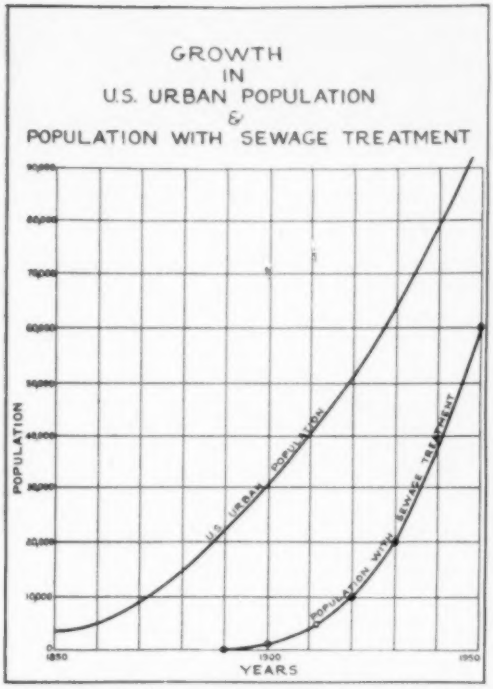
Are Present Controls Over Stream Pollution Adequate?

It is believed the answer to that question is generally in the affirmative, and that the responsibility for the correction of conditions which are now bad (due to failure to keep up with the national trend in sewage treatment or pollution abatement) is largely because of the apathy of the contributing communities. When community filth becomes a personal matter, something will be done about it.

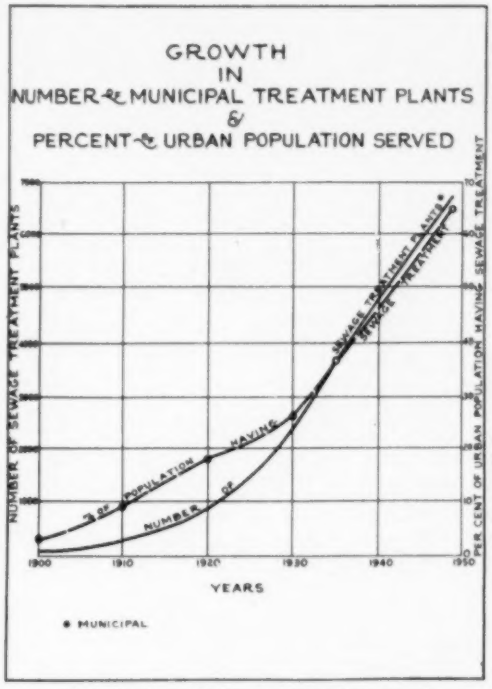
Industrial waste disposal too will make better progress as the public cares for its wastes. Education of the public and research for industry are essential steps to continued progress, the speed of which will ultimately depend upon the will of the people to clean up the streams.

At the beginning of the fifty year period, during which 60 million people have provided themselves with waste treatment facilities, there were few statutes relating to pollution. Installations were made largely for their direct benefit to the local community. When local pollution was corrected it was frequently found that conditions were still not satisfactory, due to the failure of other communities to likewise clean up. This led to the adoption of regulatory statutes by which, in most states, some agency such as the Department of Public Health could investigate pollution and order corrective measures. That this procedure

*This paper, presented before the Twenty-Fourth Annual Meeting of the Federation of Sewage and Industrial Wastes Associations, is here published by permission of the Federation.



RELATION of urban population to population provided with sewage treatment facilities.



GROWTH of municipal waste treatment plants and percentage of urban population served.

has been adequate and wisely administered is evidenced by the cooperation secured. As a result, in the last 15 year period, the wastes of 30 million people were treated, a number equal to that remaining without treatment at this time.

Yes, the patient efforts and educational work in the several states have been effective. It is believed present controls, modified in the future to meet changing needs, as they have been in the past, will continue to be adequate.

At What Government Level Should Pollution be Controlled?

The question continually arises as to whether the Federal Government should exercise control over the pollution of waterways and to what extent, if any, it should subsidize the cost of waste treatment. Congress in 1948 passed the Water Pollution Control Act establishing a policy which recognized the primary responsibility and rights of the states in controlling water pollution. The Act further provides a relatively minor annual appropriation of $22,500,000 for loans to states, municipalities or interstate agencies for the construction of necessary sewage treatment works. The Act also authorizes an appropriation of a million dollars a year to states for conducting investigations, research and surveys relating to the prevention and control of water pollution caused by industrial wastes. A third appropriation of a million dollars a year is made as a grant to states, municipalities or interstate agencies to aid in financing the cost of engineering investigations and other action preliminary to the construction of projects approved by the appropriate state water agency and the Surgeon General.

The Federal Water Pollution Control Act has no original enforcement powers but with the consent of the water pollution agency of the state where the pollution occurs, the Attorney General of the U.S. may be requested to bring suit against the offender.

The Water Pollution Control Act of 1948 is discussed by the President's Water Resources Policy Commission in its recent report, "A Water Policy for the American People." The Commission recommended that the Pollution Control Act be thoroughly tested, that the appropriation for the administrative and regulatory activities of the Public Health Service be increased, and that funds for federal loans to municipalities and other public bodies and industries at not more than 2 per cent interest be available, sufficient to cover the entire amounts required for constructing sewage and waste treatment plants.

The Commission further recommended that, "Plans for construction of waste treatment plants, whether municipal or industrial, should include reasonable provision for—

(a) making organic materials in waste available for use,

(b) utilizing by-product gas,

(c) reclaiming valuable minerals, and

(d) processing the discharged water for re-use by industry or recharging ground water."

The Commission further recommended that "if the Federal-State-local cooperative pollution program fails to provide the country with clean rivers within a period of 10 years, the 1948 act should be reconsidered with a view to providing for Federal enforcement."

Several aspects of these recommendations are worthy of further consideration. First, is that relating to time. It is believed unreasonable to predicate federal enforcement upon the failure of present controls "to provide the country with clean rivers within a period of ten years." The

pollution clean-up as hereinbefore shown has been proceeding at a rapid and continually accelerated rate. It is believed it ought to proceed along these evolutionary lines under present controls rather than the revolutionary line suggested by the ten year ultimatum.

Federal jurisdiction should be limited to the administration of existing laws and to research and guidance to the states and local government so that pollution control shall be as uniform as practicable under the variable conditions encountered.

The President's Commission report in its statement quoted with respect to reclamation, amplified further in the text, apparently disregards economic considerations. It makes the statement that "More than 18 million tons of sludge are destroyed annually, and (based on the $2 a ton removal rate paid in the Nation's Capital) at least 36 million dollars is paid for its removal. If packaged and sold instead of being dumped or burned, this sludge would gross nearly 400 million dollars a year, net a profit to the cities, and return a valuable fertilizer to the soil." I firmly believe that if packaging and selling of fertilizer is tied into future sewage treatment projects it would be a serious deterrent to the present high rate of plant construction. In most cases sludge cannot be packaged and sold except at a material economic loss.

The reason that only 2 or 3 cities, as stated in the President's Commission report, are practicing the recovery of sewage plant effluent is again evidence of the economics of the situation. To require such reuse as a prerequisite for the approval of construction of waste treatment plants or prospective loans or grants for such construction would surely retard progress.

Let us be realistic in recognizing that, while sludge and effluent may have some value in individual cases, in the vast majority of cases any revenue therefrom can be secured only by expenditures materially in excess of the revenues. While the possibility should be explored in each case let us stay on reasonably sound economic ground and not resort to propaganda and hysteria to solve our sanitary difficulties.

In this connection, I think such propaganda was shown in an article in one of our national magazines some months ago. This carried an illustration in which a drinking glass of water was labeled, "Filthy, but you drink it." The article is highly misleading. It might more appropriately have advised the public how instrumental improved sanitation has been in prolonging life under some such caption as, "Man alive—you might have been dead." The positive accomplishments of improved water purification, sewage treatment and sanitation in general have saved millions of lives. Sanitation in the future can progress along sound, esthetic and economic lines.

The President's Commission recommends that funds for federal loans to municipalities, other public bodies and industries be available at not more than 2 per cent interest covering the entire amounts required to construct sewage and waste treatment works. The Federal Government would then be in the position of a banker responsible for the safety of his loans. They should only be made for constructing works for the benefit of a limited number under terms equitable to all other citizens of the nation. These loans should therefore be repaid in full with interest within a period shorter than the useful life of the works. The interest rate should be such that the Federal Government will fully recoup all costs including those of administration.

It should be pointed out that waste treatment is within the economic reach of any people who want it. By and large practically any community in the U.S. that wants sewage treatment can finance it at a cost of approximately 1 cent per capita per day which will produce a sum sufficient to provide for the interest and amortization of the cost and the expense of operating the treatment plant. If waste treatment cannot be sold at so low a cost, then people have not been sufficiently educated either as to the requirements or the cost.

Grants in whole or in part ought not to be made by the Federal Government for waste disposal.

In the opinion of the author, the biggest deterrent to the cleaning up of some of the worst polluted streams is the idea that possibly, if conditions get bad enough, the Great White Father in Washington will put up part of the money necessary to clean up the rivers. Wastes are contributed locally and they should be abated locally—at the cost of the people who create them.

Who Should Finance Sewage Treatment?

So far as it is known to the writer, no single pollution problem is nationwide or its solution of national interest. Each is essentially a local problem affecting at most a few states.

While pollution may be more or less universal in its distribution, each instance and its correction are local problems. It is believed economically sound that each pollution problem should be solved at the lowest governmental level which exercises jurisdiction over the watercourse being polluted. In most instances that is the local municipality. In other instances, it becomes a group of municipalities, frequently organized as a sanitary district. In still others, it embraces an entire drainage area and that, in a comparative few cases, necessitates interstate compacts.

Summary

In summary, it is believed a sound national water policy as related to stream pollution should recognize that:

1. While approximately two-thirds of the urban population of the U.S. is now provided with sewage treatment facilities, serious stream pollution persists.

2. Excellent progress has been made in waste treatment, both municipal and industrial, under the present system of controls. These controls are believed adequate and should be continued.

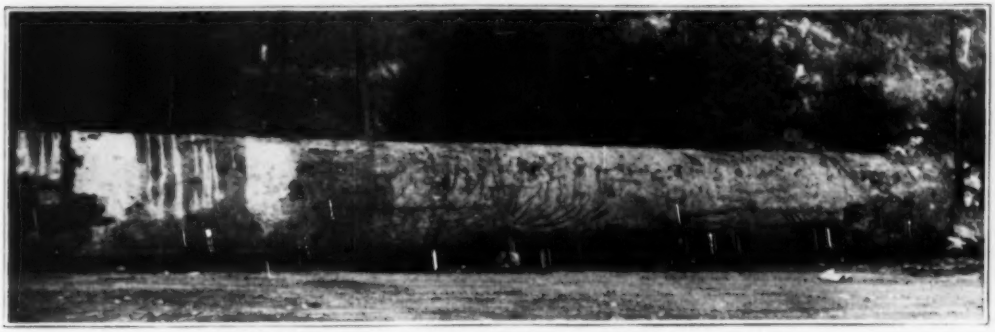
3. Stream pollution should be controlled at the lowest practicable level of government having jurisdiction over the stream.

4. Sewage treatment should be provided by and at the expense of those contributing the pollution. In general, municipal waste treatment can be provided at a cost of approximately 1 cent per capita per day (the cost of a cigarette).

5. Federal loans should only be made on projects of limited benefit on terms which are fair to all other citizens. This requires that the loan be fully repaid within a period shorter than the life of the facilities, and that the interest be sufficient to cover all costs incurred by the Federal Government including administration.

6. Greater speed in accomplishing the complete cleanup will be realized if the approval of future construction is not predicated upon questionable fringe reclamation benefits. Pollution abatement and waste treatment were essentially economic problems.

7. Control of pollution and the responsibility for its correction now lie primarily in the states where it should remain. The Federal Government should confine its efforts to administration of existing laws, to research, and to guidance to the states and political subdivisions in the formulation and enforcement of regulations having as much uniformity as is consistent with the variable conditions encountered.



VETERAN, Venturi No. 2, is encased within this section of 48-inch steel pipe.

Two Old Veterans Retired by Newark

A record of the passing of two unique Venturi meters of 60 years ago.

"Marvels of workmanship—
and enduring monuments to the
millwright's art of two centuries ago."

by LAURIE M. LEEDOM, *Construction Engineer, Div. of Water, City of Newark, N.J.*

NEWARK'S Water Division recently retired from active service two old veterans. They both entered service in 1891 and one of them worked continuously until the later part of 1949. The other stopped working in 1931. During their many years of service these two old veterans worked quietly and faithfully. They gave the management no trouble and their work was always accurate and completely satisfactory. From the day they entered service until the day they quit they had very few days off, but there was no complaint from either of them. Day and night they worked, silently, faithfully, accurately. When their labors were over and they could no longer perform their duties they were unceremoniously thrown out!

This might seem to be inhuman treatment in these days of grievance committees, guaranteed pensions and strike threats, but the veterans were not human veterans. They were Venturi meters, wood-lined Venturi meters, though veterans in every sense of the term.

Early Construction

It all goes back to the construction of Newark's original water supply system in the latter part of the last century, when these meters were installed.

Mr. Clemens Herschel was the Chief Engineer and designer of the reservoir dams and the 48-inch riveted steel pipe line extending twenty-six miles from the Pequannock watershed to Belleville, five miles north of Newark. Herschel was the originator of the Venturi Meter, which he graciously and modestly named for Italian physicist and hydraulician, Giovanni Battista Venturi.

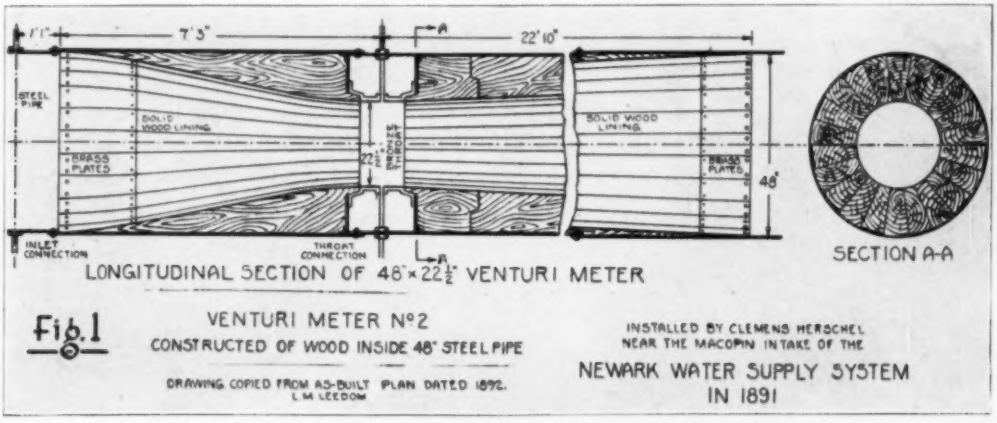


Fig. 1—Longitudinal and cross-sections through 1891 historic custom-built Venturi Meter, constructed of wood under the direction of its designer—Clemens Herschel.

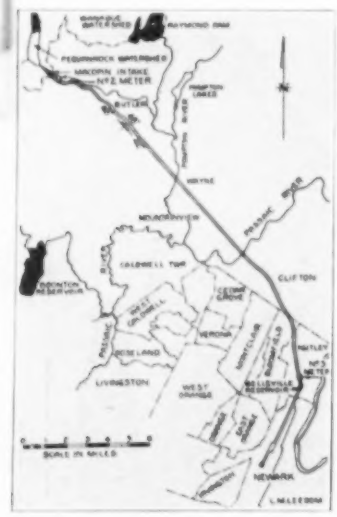
Venturi Principle

In a valuable research work on the flow of water, published in 1797, Venturi announced that fluids, under pressure, gain speed and lose head in passing through converging pipes and vice versa for diverging pipes. This statement gradually became known as Venturi's Law. Nearly one hundred years elapsed before the possibilities of Venturi's law were recognized by Clemens Herschel, Civil and Hydraulic Engineer.

Mr. Herschel wrote: "I had often had occasion to regret that I could not meter the flow of large pipes of 20 inches or greater diameter. I conceived the idea of having a gentle upstream adjutage, and a 'Venturi' expanding tube, or nozzle, downstream from the orifice. The experiments of 1887 in the Holyoke, Massachusetts, turbine testing flume were made under the influence of these ideas."

Venturi Meter

Subsequent elaborate tests on large and small Venturi Tubes, conclusively demonstrated that a remarkably constant relation exists in such a tube between the difference in pressures at the inlet and contracted section and the rate of flow. As a result, Herschel was awarded the Rowland Prize by the American Society of Civil Engineers, and the Elliot Cresson Gold Medal by the Franklin Institute, for his epoch-making contribution to the art of measuring the flow of water.



Map of Newark's original water supply system. The veteran meters are No. 2 and No. 3.

Fig. 2—Original Venturi meters at Belleville, which went into service in 1891.

Early Venturi Meters

After the Newark water supply system was placed in service it became apparent that a metering device was needed at, or near, the inlet of the pipe line. A 36-inch cast-iron Venturi meter, the first one of such size to be built in this country, had just been installed in the Newark system at Belleville Reservoir, just north of Newark. The location is shown in the accompanying map. Part of Newark's water supply still flows through this No. 1 Venturi tube, although it no longer functions as a meter.

Rather than install a 48-inch cast-iron meter, Mr. Herschel decided to build one inside the newly-constructed riveted steel pipe line. A cast-bronze throat-piece, having an internal diameter of 22½ inches, was supported inside the steel line by ⅜ inch steel diaphragm plates. In order to gradually reduce the diameter of the waterway from 48 inches to the 22½ inch throat and increase again to 48 inches, with the desired contours, he had a solid wood lining placed piece by piece, inside the steel pipe. The longitudinal and vertical sections of the meter and the manner in which the timbers were fitted in their final position is illustrated in Fig. 1.

No one now living seems to know how this Chinese puzzle was put together, each piece dovetailing the others, so that they made a solid, smooth surface, and to the proper contour. The drawings shown here were made from the as-built plan of the meter dated 1892 but the plan shows no means of fastening the various segments either to the pipe or to each other. This was Venturi Meter No. 2. It was placed in the 48-inch transmission line about 1,200 feet down-stream from the Macopin Intake.

A similar meter was also built at the lower end of the same pipe line just north of Belleville Reservoir. This was meter No. 3. Like meter No. 2, it had a bronze throat and built-up wooden decreaser and increaser, although these latter were made of two-inch planks set on rib-pieces instead of being solid wood. Both meters were marvels of workmanship and enduring monuments to the millwright's art of two generations ago. So far as our records indicate, they were placed in service as soon as completed and gave continuous and completely satisfactory service until their retirement.

Herschel Experiments

Mr. Herschel conducted many experiments on the No. 2 meter at Macopin Intake. The pipe at that point is about 37 feet below the level of Macopin Intake Reservoir, so that it was practical to connect glass piezometer tubes to the Venturi meter at the inlet, throat and outlet. The tubes were supported by a wooden tower having steps and landings at suitable levels. Readings of the water level in the three tubes provided data from which Mr. Herschel and his assistant, Mr. J. Waldo Smith, computed the amount of water passing through the meter and the total loss of head across it. Three times a day Mr. Edward Blakely, the faithful Reservoir Attendant at Macopin Intake, climbed the steps of the tower to take the readings. In freezing weather the tubes were drained between readings.

Registering Devices

Later, mechanical registers, the invention of Frederick N. Connet, late

Chief Engineer of Builders Iron Foundry, were installed for this meter and for the meter at Belleville. Mr. Connet's contribution to the "art" was second only in importance to that of Mr. Herschel and also earned the recognition of the Franklin Institute. In March, 1939, a Chronoflow transmitter was installed on the meter at Macopin Intake. This is an electric telemetering device which transmits readings to the water treatment plant, about 1,000 feet up-stream from the meter.

During the years in which these meters were in service they were checked several times by pitometers and found to be amazingly accurate, the pitometer results agreeing with those of the Venturi meters to within a small fraction of one per cent.

Newark's Second Pipe Line

The original plans called for one 48-inch pipe line between the watershed and Belleville. This line did not have sufficient carrying capacity, so a second line was built parallel with the first. The first five miles of this new line was 48 inches in diameter. It was then reduced to 42 inches, and continued to Belleville with a diameter of 42 inches. This supplementary line was equipped with cast-iron Venturi meters: 48-inch at Macopin Intake and 42-inch at Belleville. The 42-inch meter at Belleville was located alongside the old No. 3 wood-lined meter, but in a separate masonry vault.

New Venturi Meters

Last year a contract was let for the removal and replacement of the two wood-lined Venturi meters. The old No. 2 meter at Macopin Intake was replaced by an all-metal meter, the throat piece being of cast-iron with a bronze liner, and the decreaser and increaser of welded steel. The old No. 3 meter at Belleville was replaced in a similar manner, except that a cone valve was installed adjacent to the down-stream end of the throat-piece.

Cone Valves in Venturi Meters

It has been the practice in Newark to install cone valves of much less diameter than that of the pipe line in which they are placed. In order that the constriction will not cause too much head loss, Venturi decreasers and increasers are used. These are made of welded steel plate with standard A.W.W.A. steel flanges welded on the small ends for connecting to the flanged cone valves. The large ends are usually welded to the pipe line. In this way much smaller, and less expensive, cone valves may be used, and since the Newark water supply flows entirely by gravity, the slight head loss across each cone valve installation is not too serious.

The location of old No. 3 meter was a "natural" for cone valve installation, being just up-stream from Belleville Reservoir, where more than two hundred disc valves, of various sizes and various degrees of workability, control the flow of water through a maze of pipes and connections. One cone valve placed adjacent to the down-stream end of the throat of the meter would take the place of several old disc valves. It was entirely logical and economical to make such an installation, since such a valve in the full open position would not impair the accuracy of the Venturi meter. For the same reason a cone valve was also installed "in" the cast-iron meter alongside, in the 42-inch line. This involved a slight change in the meter castings because the throat was 22½ inches in diameter and standard cone valves are not made in that size. An 18 inch valve and throat size was decided upon and two new castings were made and installed to accommodate the valve.

The old No. 3 meter, with the wood lining, had a 22½ inch diameter throat but this was reduced to 20

Fig. 3—New Venturi meter and cone valve installation, replacing the "Veterans."

Fig. 4—Wood Lining—note the eroded surface after 58 years of service.

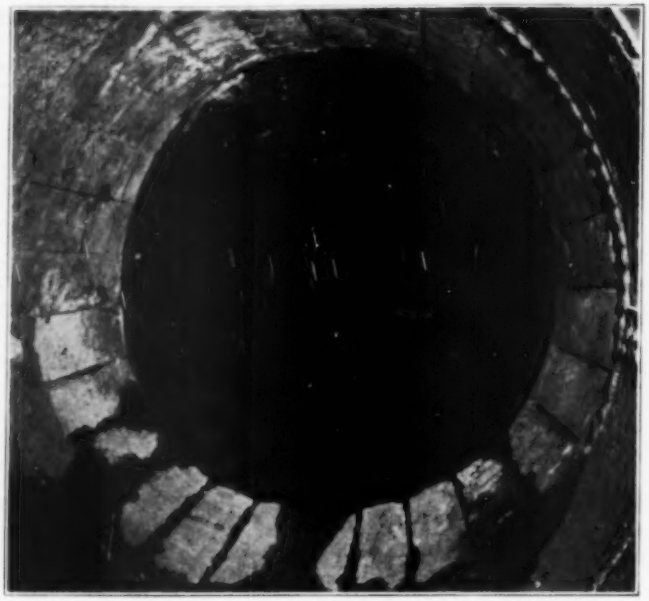


Fig. 5 Inlet End—note condition of brass plates, wood lining, and throat piece.

inches in the new all-metal meter to conform with a cone valve of that size. The old separate vaults were removed and the new meters and valves housed in one concrete vault.

Fig. 2 shows the two old meters. The 48 inch meter on the left has no resemblance to a Venturi meter because it is all inside the steel pipe. The bags and salt hay were placed around the piezometer taps and ring, on the outside of the pipe to prevent freezing. The concrete floor of the new vault was covered with salt hay for the same reason.

Fig. 3 shows the new Venturi meters and cone valves. The 42 inch pipe, in the foreground, was in service when the photograph was taken and the inlet and throat taps were protected from freezing. The cone valve was covered with tar paper to discourage neighborhood pranksters from closing the valve. These valves operate very easily and even children would have no difficulty in shutting off one of Newark's main supply lines. The 48 inch line with its Venturi meter and 20 inch cone valve was not in service at that time. The piece of 8 inch cast-iron pipe was installed to carry the electric cables from the Chronoflow transmitter to the recorders placed in the reservoir gate house on the far side of the road. These meters were attached to the pipe lines at the up-stream end by Dresser couplings to provide for expansion and contraction.

The two cone valves were made by S. Morgan Smith Co. of York, Penna. The new Venturi Tubes were made by Builders Iron Foundry of Providence, R.I.

Removal of Old Meters

The removal of the old wood-lined meters was eagerly awaited in order that a careful inspection could be made of the interiors. When the wood-lining was installed, the feather-edges of the timbers, where they joined the steel plates, were covered with brass plates. The brass plates were about one-eighth inch thick, three or four inches wide and eighteen inches long. At one end they were attached to the timbers with wood screws and at the other by brass rivets through the steel plates. The dissimilar metals caused a galvanic action and in later years produced quite a number of leaks. With a water pressure of about 100 psi, holes in the badly pitted steel pipe were difficult to repair.

The No. 2 meter at Macopin Intake was removed in one piece. See photograph at the head of this article. An examination of the interior showed that the wood lining had been somewhat worn away during its many years of service. Erosion was evident at the ends of the timbers, both where they joined the bronze throat and where they tapered down to the brass plates.

Knots in the wood had not worn as much as the softer parts. This is illustrated in Fig. 4. The maximum wear appears to be about $\frac{3}{8}$ inch. The woodwork, as shown in Fig. 5, was in good condition considering that it had been in service for 58 years. During this time approximately 530 billion gallons of water flowed through the meter.

The No. 3 meter at Belleville could not be removed in one piece. When the sections of pipe containing the wood lining were picked up by a crane, the whole interior collapsed and slid out of the end, a mass of slimy boards. Prior to lifting out the section containing the meter a partial inspection was made from the inlet end. The contour of the meter appeared to be perfect but a subsequent examination of the individual pieces showed considerable rotting had occurred.

There is no record of any repairs being made to the wooden lining of either meter during the 58 years they were submerged. Piezometer piping had to be replaced, and recording mechanisms were changed as new designs were invented and constructed, but the Venturi tubes themselves remained unchanged throughout the years—a fine tribute indeed to the man who conceived the idea of wood linings and to the men who executed it.

Old Meters Scrapped

Prior to removing the old wood-lined meters the author made an effort to interest an engineering society, historical society, or individual in preserving these relics for posterity. The No. 2 meter, with its solid timber lining, could have been split longitudinally to show the internal construction, but it would have been an expensive job and a rather neat problem to retain in position the various pieces of wood. In addition, it would have been necessary to treat the timbers with a preservative. While the timbers lasted remarkably well under water, they would soon crumble to dust upon exposure to the atmosphere. Finally, considerable space would be required in order to exhibit the pieces of pipe. Finding no one who cared to assume the responsibility and expense of converting the old meters into museum pieces, it was necessary to consign them to the scrap heap.

And thus came to a rather ignominious end two fine old "veterans" who for many, many years had given faithful, untiring service.

Chairman
Robert W. Austin
Hydr. Engr.,
Public Serv. Comm.,
Albany, N.Y.

Speaker
Gerald E. Arnold
Director,
Water Rec. Div., NPA,
Washington

New York Section AWWA Holds Winter Meeting

The New York Section of the AWWA holds a winter luncheon meeting each year—and provides a short but full program. Held in New York City during the time officers and directors of the National Association are in session, it is an annual event to which all these officials are invited guests. At the meeting on January 15, 1952, the AWWA's President Berry, Vice-President Capen, and Vice-President-elect Cunningham were at the head table.

Robert W. Austin, chairman of the New York Section, presided. He announced that the spring meeting of the Section will be held in Syracuse. Brief reports were presented by J. M. Diven, membership committee chairman (the section now has an even 700 members), and by Earl Devendorf, civilian defense committee chairman. J. C. Harding, chairman of the water resources committee on the Incodel Project recommended that approval of enabling legislation should be forthcoming from the present session of the state legislature.

Col. Chevalier Forsees An "Arsenal Economy"

First of the two speakers at the meeting was Col. Willard Chevalier, Executive Vice-President of McGraw-Hill Publications, who commended past and present engineers who have served New York City in its long-range water supply and sewage disposal planning.

According to Col. Chevalier, the United States and Canada is in a transition period which he termed an "arsenal economy." This country is coming to recognize that its economy must be designed, not for war, but to provide protection in its international relationships. The resources of North America must be pooled to organize productive capacity as a permanent arsenal. Properly directed, this transition period may be able to guarantee a hundred years of peace.

Gerald Arnold Reports on Water and Sewage Materials

The availability of maintenance, repair, and operating supplies for water and sewage utilities was discussed by Gerald Arnold, Director, Water Resources Division, NPA. Mr. Arnold is on loan to the federal government from his position as Chief Engineer of the San Diego, Calif., water department.

According to Mr. Arnold, the 30,000 water and sewage systems of the U.S. are vitally concerned with the availability of materials regulated by the Controlled Materials Plan. He described the operations and procedures involved in the allocation of these supplies, and candidly reviewed the outlook for the future.

There are signs that the shortages of steel and aluminum are easing, with new capacity under construction to produce each of these metals. The situation regarding copper, however, is not a happy one; so little increase in the production of this mined metal is in prospect that the available supply must be used judiciously. Substitute materials for copper should be thoroughly investigated. Copper for water meters is considered essential, since studies show water savings as large as 30 per cent in metered systems (and if systems are not metered the requirement for pumps, motors, pipes, and other equipment is increased).

Mr. Arnold strongly urged that water and sewage utilities make plans and applications *now* for the entire year of 1952, in order that the NPA Water Resources Division can establish its allotments for the year as soon as possible. His Division is anxious to serve the needs of these utilities, and will cooperate to secure supplies when real emergencies arise.

In reply to questions from the floor, Mr. Arnold commented on the new 45 day limitation applying to supply of cast iron pipe. It was not the original intent to have this apply to cast iron pipe for water and sewage utilities, and a change in the regulation is expected to be made shortly.

Limitations on the use of scarce materials apply to each project for each quarter year. Under a new ruling, steel mills may accept approved orders and hold these for subsequent delivery if delivery cannot be made in the quarter for which the order is accepted.

A particularly short material is lead, and this metal may be scarce for a long time to come. This presents a particularly difficult situation, because lead substitutes—such as sulfur jointing compounds—are also in short supply. There is a shortage of sulfur, and therefore of sulfuric acid, but adequate allocation has been provided to supply water works needs of alum. Another order insures the chlorine requirements for sanitation needs.

Hey Bud! See anything of a broken water main hereabouts?

Maintenance, Operation and Repair of Deep Wells and Well Pumps

Wherein a number of surprising disclosures have altered previous practices.

by J. B. MURPHY, *Senior Service Engineer, American Water Works Service Co., Inc., Philadelphia, Pa.*

BECAUSE of the nature of the business of public water supply, we cannot handle our maintenance problems in the same manner as industry in general. Continuity of service is the prime requisite and perhaps second only to quality of the water served. The writer has found that most turbine well pump manufacturers will recommend the continued operation of a unit until such time as its capacity and/or its efficiency are so reduced as to make it desirable to pull the pump, or until such time as an out-and-out failure occurs. We must do everything to minimize the risk of an outage during peak periods or peak seasons of pumpage. If a water works were in such fortunate position as to have enough complete installations of wells and pumps as to stand the outage of units at any unpredictable time, we think that the manufacturer's recommendations would, in the long run, be the most economical. This is a situation that rarely exists.

Prior to World War II our company made an effort to establish a fixed inspection period for all well pumps. On the basis of operating experience with other types of rotating equipment, this period was set at 8000 operating hours, or every two years, whichever was the shorter period. Serious effort was made to place this in effect throughout the system. Pumps were removed and inspected with particular emphasis on preventive maintenance. Parts that we thought might give trouble within the next operating period were replaced. From an operational standpoint this seemed to be quite successful and we believe that we had a minimum amount of emergency repairs on equipment so maintained.

During the war it was impossible to maintain this inspection schedule throughout the system. In 1949 we sent out a questionnaire to all plants in our system operating this type of equipment in order to determine when well pumps were last inspected, what conditions were found, and how best to organize our maintenance schedule so as to again restore our former standard of inspections.

The results of this questionnaire were surprising. It was clearly indicated that the arbitrary schedule of 8000 operating hours or every two years was costing money. Many units had operated trouble-free for periods in excess of 8000 hours with the extreme case being 51,000 operating hours to the date of the report and still going. In evaluating the history of all the units in the system we find a number of variables, the most obvious of which is the operating speed of the unit. The 51,000 hour job operates at 860 rpm. Many of the units that had operated to date of report in the neighborhood of 15,000 hours were in the 1160 rpm. class. Several 1750 rpm. units had operated for extended periods up to 30,000 hours. In no case had a 3450 rpm. unit operated beyond the 8000 hour period. The writer does not mean to imply that failures had occurred at the end of these periods. We found that units operating trouble-free at 1750 rpm. for very extended periods of time were relatively shallow settings, generally less than 100 feet. Another variable is the corrosive quality of the water being pumped.

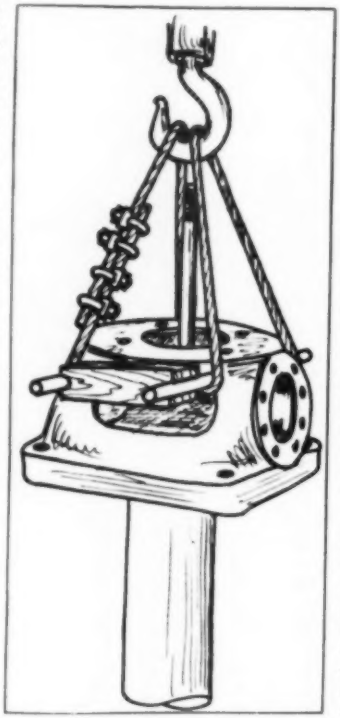


Fig. 1—Safe method of rigging for first lift where no internal lugs are provided.

Pump Inspection Procedure

After studying these results we decided an individual inspection period must be established for each unit. In a few exceptional cases 8000 operating hours is too long a period. In most cases it is far too short. We have now extended the period to varying lengths of time up to a maximum of five years, based on the recommendations of the local operators and on our own judgment. The maximum period of five years is considered only where the water is relatively non-corrosive or where units in standby service accumulate a minimum number of operating hours. The individual inspection schedules will be adjusted to suit the conditions as we gain further experience. In order to improve our knowledge we have devised an inspection report form so that we will have an accurate record of the conditions of wear and corrosion encountered in every unit.

In general we prefer to pull well pumps, inspect them, and overhaul them with our own employees. In some cases where the plants are so small and the number of operating personnel so limited as to prohibit this, the work is let out on contract. We know that in a few instances it is costing more to handle a unit with our own employees than it would to contract the job. We feel that the small added cost is more than offset by the knowledge of the machine

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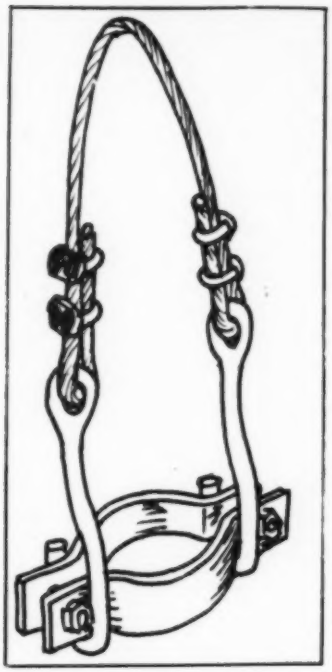


Fig. 2—Arrangement of hand forged steel hooks, forged steel bolted clamps, and cable sling for lifting column sections.

gained by our employees. There is no question but that an operator thoroughly familiar with the construction of a piece of machinery is better qualified to operate it. Every plant should be equipped with qualified men and necessary equipment to remove and overhaul a unit quickly and efficiently in the event of an emergency. Also, in an emergency it might not be possible to obtain the services of an outside concern equipped to do such a job. We are gradually equipping plants having a number of installations to maintain with light portable power equipment for the hoisting of pumps. With power equipment we can remove a unit in five or six hours, formerly requiring two to three working days to remove using a chain hoist. The crew can be reduced from five men to three men and in an emergency two men can handle the average sized unit.

Special Rigging Equipment

The general lowering of water tables has required the lengthening of pump columns and other changes to existing pumping equipment. We have found in some cases that our hoisting equipment has been seriously overloaded. Installations which were originally designed for three tons, and having hoisting equipment of this nominal rating, now weighed as much as five tons. This came about so gradually that no one realized what was happening until chain hoists became jammed due to overload, or there was some other indication. These conditions have, of course, been corrected. The handling of a well pump is essentially a rigging job.

There are operations in the assembly and disassembly of the unit which require an individual's hands to be located under heavy suspended parts. There is no practical way to avoid this. The only safeguard is to rig with extreme care and to handle every part in the prescribed manner. Some makes of pumps have lugs cast integral with the discharge head for the purpose of making the first (and heaviest) lift. A four-part cable sling arranged so as to clear the pump shaft end should be used. Where these lugs are not provided two bars should be arranged with wooden spreaders as shown in Fig. 1 and the lift made with a four part sling as shown. Do not use eye bolts in the tapped bolt holes used for motor mounting. Unless the pump is designed for an extremely shallow setting the eye bolts are not of adequate size and strength to bear the weight of pump and column.

Fig. 2 shows a simple assembly of iron clamps, hooks and slings for the safe lifting of the pump after the motor and head are removed. Wooden clamps are also satisfactory but are cumbersome. In Fig. 3 is shown an arrangement of chain and hooks for supporting the oil tube and shaft during disassembly and "tailing out" of the complete section of column.

Where it is possible to do so, a test procedure should be established so that you will have a continuing record of both pump performance and well performance. An air line and altitude gage is the simplest method of determining water levels in the well. The air line should, however, be installed with extreme care to absolutely insure that there are no leaks and that it is not damaged during installation. The altitude gage should be checked at intervals to insure that it is reading correctly. A false air line reading is decidedly worse than no reading at all, as it will lead to completely false conclusions.

Fig. 4 illustrates the general arrangement of a pump in a well, the names of the various major parts of

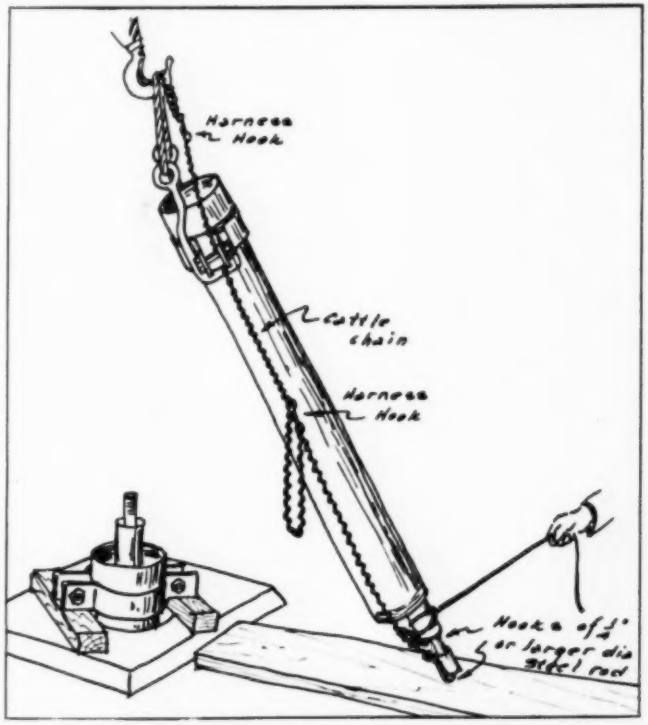


Fig. 3—Chain and hook device to support oil tube and shaft during disassembly of a section of column.

the well and pump and given; also, defined are such terms as "static level," "pumping level," and "drawdown." The fundamentals of a well and pump test are also illustrated.

At any time a pump is removed from the well, the well should be sounded to the bottom to determine if any fill-in has accumulated. If there is any accumulation it should be removed with a bailer to determine its nature. In the case of open rock holes accumulation is apt to be in the form of small pieces of rock debris from the sides of the well. This, consolidated with fine materials deposited from the water, may seal off water-bearing passages in the bottom of the well. Sand accumulating in a screened well may indicate inadequate development of the well, overpumping of the well, or deterioration or failure of the well screen. Of course any accumulation of gravel (larger than would pass the nominal slot size of the screen installed) is an indication of screen failure. In this case you need the advice of a competent driller.

Restoring Well Capacity

Overpumping of a well is a natural tendency that should be avoided. As a general rule we like to pump a well at about one-half the maximum rate possible. If the general water table in your area has lowered you can expect the specific capacity of your well to be affected by it. If, however, the water table has not changed appreciably and there has been a decrease in specific capacity, the trouble is a local one in the well. It may be possible to restore original specific capacities by chemical treatment. We have used "Calgon Treatment" with some success. It is simple to apply, is not dangerous to handle, and is relatively inexpensive. It can be done without removing the pump from the well and requires about 48 hours to apply. Its results can be measured only by running an accurate test before cleaning and establishing the specific capacity of the well. After cleaning a test should be run at as near the same rate of delivery obtained during the first test as is possible and the specific capacity again established. The measure of worth is, of course, the percentage of improvement in specific capacity. If capacity alone is used as a measure, a false impression will be obtained as the hydraulic characteristics of the pump will be introduced in your results.

A high test hypochlorite should be applied with the Calgon during treatment as this poly-phosphate serves as food for bacterial growth. Calgon, Inc. recommends the application of a high test hypochlorite where the presence of iron fixing bacteria is suspected. We recommend that the hypochlorite be applied arbitrarily, whether or not the presence of these bacteria is suspected.

We have used Calgon treatment in some old Pennsylvania rock wells which had been operated for years by air lift, carefully testing results. On our first test well the initial application of Calgon gave an improvement in specific capacity of about 17 per cent. The second application gave an improvement of about 10 per cent. The third application gave an improvement of about 5 per cent, or a total improvement of about 33⅓ per cent. The writer observed these tests. Water discharged from the well after the first 48 hour treatment was turbid, but did not carry large quantities of suspended matter. The second application brought up patches of leathery looking material which was apparently an organic growth.

We tried similar treatment in some Ohio rock wells with negligible results. An experimental treatment with acid in the same wells also gave negligible results. These results are not conclusive however, as it is quite possible that there is such a quantity of material present as to have a very great demand for the chemical applied. We hope to explore this further at a later date. We have had repaying results from these same wells merely by bailing out accumulated debris from the bottom of the well. The action of a bailer entering and leaving the well may have some surging or back-wash effect.

We have recently completed a Calgon application in a screened well on the Jersey shore. The first application gave us a 15% improvement in specific capacity. Further treatment must be delayed until later in the year.

If Calgon treatment is unsuccessful or only partially successful, acid treatment may be effective. The acid should be a solution of commercial muriatic to which is added a suitable inhibitor so that the acid will attack clogging deposits without attack of the metal parts. Since the acid is hazardous to handle, it is preferable to have the treatment applied by a company experienced in its use and application to well cleaning. If the

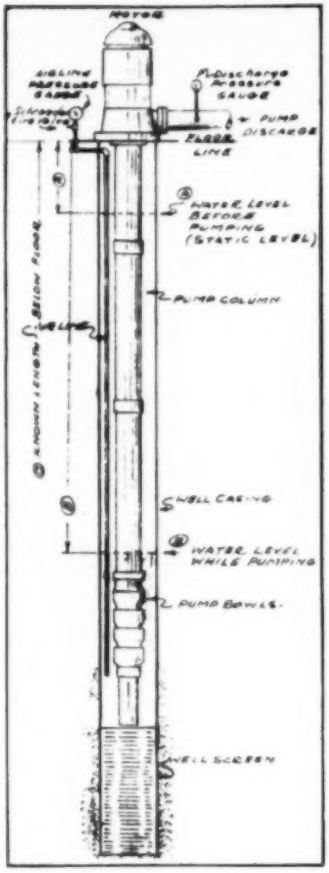


Fig. 4—Well Terminology and Testing Nomenclature.

A = *static level* (water level before pumping)

B = *pumping level* (water level while pumping)

B less A = *draw down* (amount water is lowered by pumping)

GPM = *gal. per min.*

$$GPM = \frac{GPM \text{ per foot of draw down}}{\text{draw down}}$$

C = *airline of known length.*

This provides a means of measuring water level. Air pumped into airline through a schraeder valve stem with a hand pump will attain its maximum stable pressure when all water is displaced through open bottom end of airline. As one pound of pressure will displace 2.31 feet of water, the known length of airline C minus airline psi. $\times$ 2.31 = distance from floor line to water line to water level in well.

FH = *field head.* Pounds discharge pressure $\times$ 2.31 plus elevation of discharge pressure gage above floor plus distance below floor (in feet) to water level in well.

$$\frac{FH \times GPM}{3960} = \text{Water horsepower}$$

KW = kilowatt input to motor (from watt hour meter)

$$\frac{KW}{0.746} = \text{horsepower input to motor}$$

$$\text{Brake horsepower} = \text{HP input to motor} \times \text{motor efficiency}$$

$$\frac{\text{Water horsepower}}{\text{Brake horsepower}} = \text{field efficiency of pump}$$

$$\frac{\text{Water horsepower}}{\text{Horsepower input to motor}} = \text{wire to water efficiency}$$

well screen is already heavily corroded, acid cleaning may weaken it mechanically and cause it to collapse. Of course, if this condition exists the failure will occur sooner or later with or without cleaning.

Sometimes loss in specific capacity is due to the pulling of fine material into the developed area around the well screen. This condition may be improved by mild surging. Surging may be accomplished by starting and stopping the pump, discharging the water to waste. At no time should the pump be stopped when it is still handling an appreciable amount of sand as the pump is very apt to sand-lock. A sand-locked deep well pump may be freed by backwashing with water while alternately raising and lowering the rotating element of the pump by the top adjusting nut. It may be necessary to drive the pump shaft down with a wooden block and hammer until the sand is washed out. This method of development will also result in some excessive wear to the pumping unit and is a factor which must be considered.

Application of Dry Ice

We have experimented with the use of dry ice in order to surge a well. It is relatively cheap and is a simple experiment. We have not had too much success with it. It has the disadvantage of being an uncontrolable force once it is deposited in the well. In some early experiments the dry ice was broken up into small pieces. While dry ice is much heavier than water, small pieces will form gas so rapidly as to float. In our first experiment this occurred with the result that the water at the surface of the well froze solid. The next trial was made using lumps of dry ice about the size of a man's fist. While this worked better, the well blew in a manner similar to an air lift when first put in operation, blowing about half of the dry ice back out of the well. In the next experiment, a tubular carrier was made of ½ in. hardware cloth just small enough in diameter to clear the sides of the well. It was made long enough so that about 750 pounds of dry ice could be packed into it. This filled carrier was, of course, of sufficient weight to drop rapidly to the bottom of the well. The disturbance was violent and continued until the dry ice was exhausted. If any benefit is to be obtained from the use of dry ice, the carrier seems to be the best way to introduce it into the well. In this particular experiment, no benefit was obtained from dry ice or any other type of treatment.

At one plant we have rock wells which are used during periods of high stream flow as recharge wells, in order to introduce water from a surface stream into the well field. Originally these wells would accept about 500 gpm., but they became so filled up in one season that they would accept no measurable quantity of water. Treatment with the dry ice bomb described has been successful in restoring these recharge wells to original capacity. The wells are about 6 in. nominal diameter, and when they blow a column of water is discharged 30 or 40 feet into the air.

Grouting Technique

We have attempted to clear up screened wells by redeveloping and

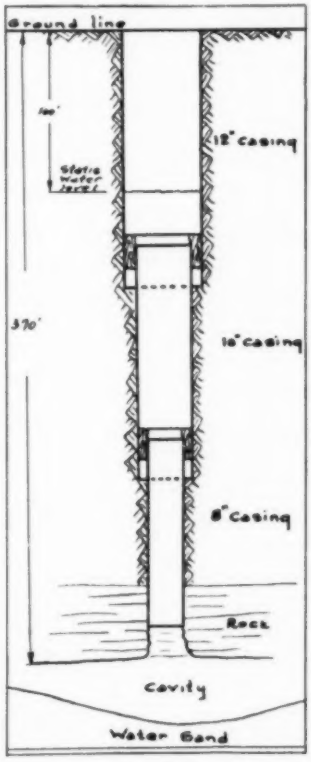


Fig. 5—Cross-section of well having a casing terminated in rock.

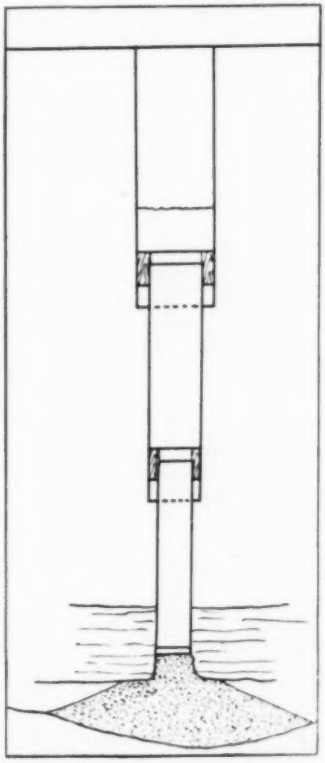


Fig. 6—Well illustrated in Fig. 5 showing use of sand to fill cavity.

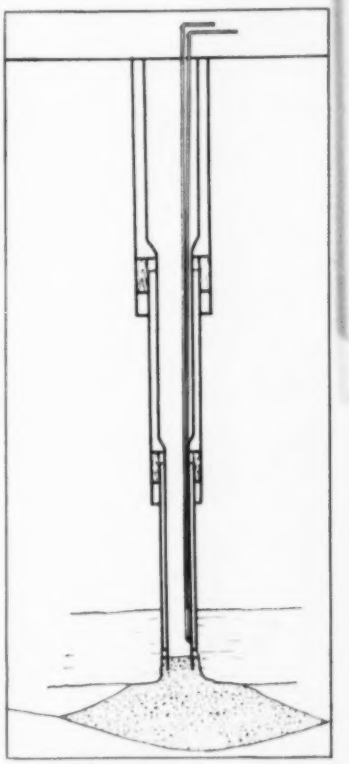


Fig. 7—Well illustrated in Fig. 6, showing installation of grout pipes on right. See Fig. 8 for detail.

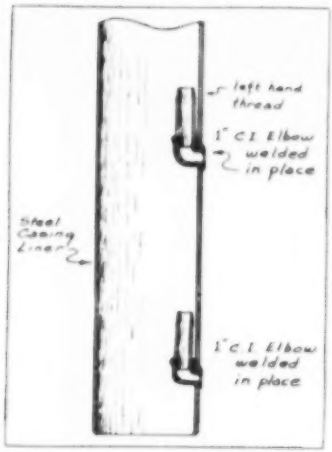


Fig. 8—Lower end of casing liner with elbows employed to feed grout. Text describes technique.

surging with a plunger or surge block operated on a drilling rig. This is a severe method and may actually result in the loss of the well. If there is a considerable percentage of fine material present in the water bearing formation, it is possible to continue pulling this fine material into the well and cause a major cave-in. In areas where our usable water bearing formation is at considerable depth and where corrosive or other objectionable water-bearing formations exist above it, we have experienced casing failures. We have had considerable success in the introduction of steel casing liners of one nominal pipe size smaller diameter than the original casing. We have been able to cement off the annular space between the two casings for the complete depth of the well, thus giving us a new standard weight steel casing protected on the outside with a coating of neat cement for its entire length. Such a job should last for a long time. Our methods are simple and can be employed by anyone having equipment to lower the casing into the well.

Fig. 5 represents a foreshortened cross-section of a well having a casing terminated in rock. Any liner installed in this type of well should be extended to a point below the original casing. An accurate record of the construction of the well is necessary. As illustrated in Fig. 6, the lower portion of the well is filled with screened sand to a point 6 in. to 1 ft. below the old casing. The sand is tamped to insure a stable level.

The casing is equipped with two left hand thread elbows welded in place as shown in Fig. 8. One elbow is located about 2 ft. above the bottom end of the liner and the other about 5 ft. higher. Grout pipes are connected to the elbows using right and left hand threaded nipples. These pipes are installed with the liner sections, being added as the liner sections are welded on. One set of grout pipes is marked with paint to insure that there will be no mistake as to which pipe is which. Liner and grout pipes are installed until the lower end of the liner is about 6 in. to 1 ft. below the level of the sand, as illustrated in Fig. 7.

A mixture of 7½ gallons of water to one bag of Portland cement is pumped or poured into the grout pipe having the lower connection. Just enough is put in to fill the annular space to a point between the upper and lower grout elbows—*no more*. Enough water is added to force the grout from the grout line into the annular space. The feeding of the grout and the added water must be a continuous operation. If the flow is interrupted, the cement slurry will bridge in the pipe.

The purpose of the preliminary cement charge is to provide a matte on top of the sand which will later bear the weight of the main portion of grout. It is allowed to set for 24 hours. Grout is then fed through the upper pipe until the annular space between casings overflows. As the grout level settles, makeup is poured in from the surface. In both cases at the end of a 12 hour period it is wise to turn the grout pipes with a wrench in a clockwise direction just enough to crack loose the left-hand threaded joint at the bottom end. This will insure that the pipes will break loose for screwing out readily at the end of the entire period. After 36 hours, the grout pipes may be removed by unscrewing them at the left hand threads. A heavy weight is lowered into the well for the purpose of snapping off the two elbows flush with the liner wall. The sand (and elbows) may now be removed with a bailer. Now we have a long lived liner cemented in place for its full length.

Contamination from Nearby Wells

One must be constantly informed as to neighboring wells and their behavior as they can seriously affect your own supply. As an example of this, in the plant where we found it necessary to first develop and use our method of lining casings, we found at one location that repairing our own wells was not enough. In this instance it was easy to determine leakage, as the objectionable waters were high in chlorides. The chloride content of the formation pumped normally was 7 to 9 ppm. At one location, the

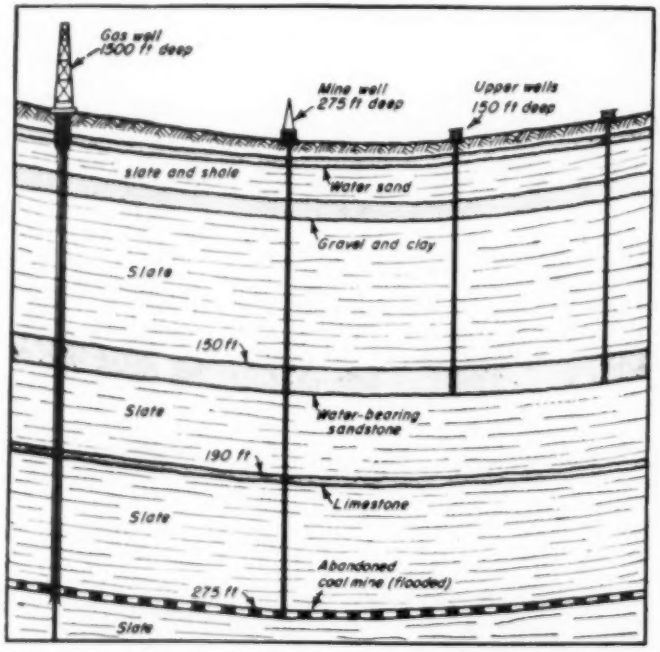


Fig. 9—Wells in sandstone formation. Effect of gas well and mine well are described in the text.

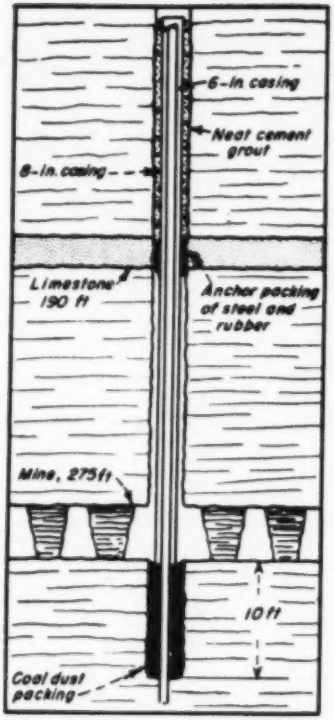


Fig. 10—Expansion packing to seal drainage of well into mine.

chloride content was about 50 ppm., a concentration indicating pollution. We surveyed our wells using a conductivity meter, lowering the cell into the well and taking readings at every 5 foot interval. With this procedure we were able to accurately locate leakage in the wells. Liners were installed as formerly described, effectively repairing our wells. The chloride content of the water in this general area was not improved appreciably. Examination of records showed four other wells in the immediate area belonging to other companies. Two of the wells were abandoned and lost, their exact location being unknown. At considerable expense, the abandoned wells were located and sealed, thus effecting some improvement in the quality of our water at this location. The other two wells are still in standby service and have not been repaired. We believe there is some leakage occurring in these wells.

Well-Shooting to Improve Flow

Shooting a rock well with an open charge of nitroglycerin or dynamite is a risky business. It is done generally on a new well that does not produce the water expected. If you are obtaining some water from the well the detonation of an open charge in the well may improve the flow, or it *may* destroy it. The chances are just about 50-50.

There are other hazards. At Clinton, Iowa, our wells are located in sandstone to a depth of more than 2,000 feet. Our newest well at this plant was drilled a few years ago. On first test it was a poor producer. This well was shot at a point near the bottom and at a point around the 1,400 ft. depth. A great deal of material was blasted loose into the well and was bailed out. In this instance, during bailing operations, a large quantity of material caved in on the driller's tools. It took a great deal of time and cost a great deal of money to overcome this difficulty. However, the shots were effective in improving the capacity of the well which is now operated at around 1,200 gpm.

During World War II "shaped-charges" were developed. The explosive force of these charges is highly directional. Such a charge is used in the familiar Bazooka projectile. In 1948, one company devised a method of using shaped-charges in a well in order to perforate and shatter the rock, opening it up so that there would be a better flow into the well. This method was developed primarily for the oil industry. In recent months it has been applied to water wells. After studying the log of the well and any geological reports available, a recommendation is made as to the number and location of shots to be fired. The charges are arranged on a carrier one foot apart. They fire in both directions. It is claimed that they will perforate rock, depending upon its nature, up to about 2 feet. We have just completed a rock well in Indiana which was very disappointing, yielding about 170 gpm. with a 70-foot drawdown. Arrangements were made with the company cited to shoot the well for us. A 7-foot carrier containing 7 double charges was fired at about 140 feet. Five carriers containing 35 double charges were fired from 210 feet to 245 feet. The total cost of this job was under $1,000. Yield was improved from 170 gpm. to 226 gpm. with the same drawdown, a net gain of about 27 per cent. While this gain was not spectacular, it was well worth the cost. Indications are that we will be able to pump this well continuously at about 270 gpm. This method offers one major advantage. There appears to be no danger of collapsing the formation and, thereby, to lose the existing capacity. The amount of material or debris falling into the well from the treatment is so small that it is not necessary to bail out the hole.

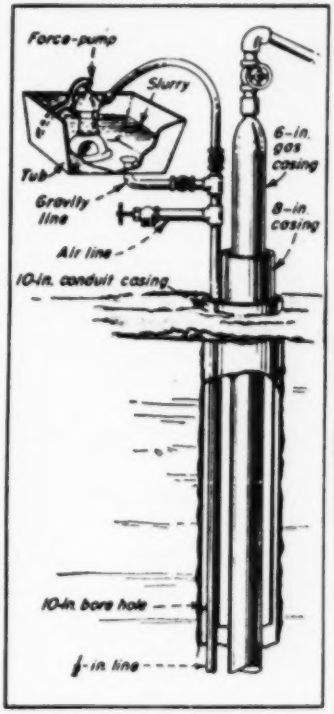


Fig. 11—Equipment for adding cement grout through ½ in. pipe.

Gas in Well Waters

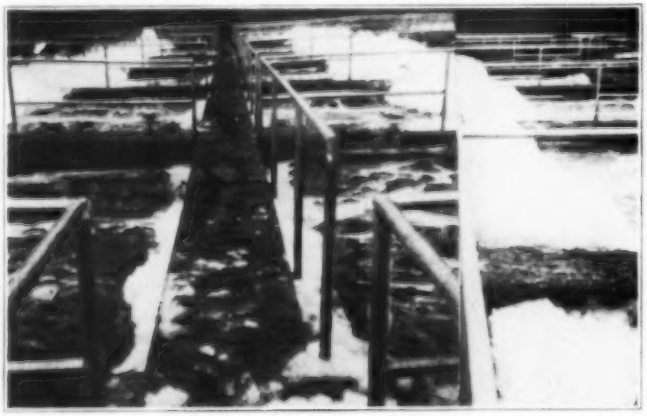
In a Pennsylvania plant we have a number of wells that had been pumped for years by air lift. We did some rather extensive testing and installed motor driven turbine pumps in these wells. We found that one well could not be pumped at the estimated capacity due to the presence of entrained gas in the water. Natural gas was found to be present in sufficient quantity to burn steadily at the discharge nozzle of the pump. It is not too unusual to find some natural gas in water bearing formations, particularly in the oil field district of Pennsylvania. We realize that, due to the air lift operation, this gas could have been present for many years without our realizing it and without interfering noticeably with the capacity of the well. Turbine pumps will not handle any appreciable amount of entrained air or gas as they act as a centrifuge and become vapor bound. We were about to abandon the well on the assumption that the condition could not be improved. The local manager was aware that our wells were surrounded by an

old oil lease which was operated marginally and not too efficiently. He investigated to determine if there had been any recent change in operation of the lease. He found that there had been a change and that gas pressures in the oil wells had been allowed to accumulate to several psi. He arranged with the owners to relieve the pressure from their oil wells and to keep it relieved. Apparently the oil well casings were leaking badly and when pressure was allowed to accumulate, the gas was forced out through holes in the casing into water bearing strata. As soon as this pressure was relieved the quantity of gas in our well was reduced and we were able to pump the well at our estimated capacity.

Mine Waters in Wells

At still another Western Pennsylvania plant we have a number of wells taking water from a sandstone formation at a depth of about 150 feet. These are illustrated in Fig. 9. A number of years ago a survey was made of an abandoned coal mine about 250 feet deep underlying this formation. It was determined that the water from this filled mine could be handled satisfactorily with our existing treatment facilities. The mine would provide an excellent underground storage reservoir of large capacity. A well was drilled into this mine, cased off with 12 in. cast iron pipe, and cement grouted in place. This job was successful, water being pumped from the mine with a conventional turbine well pump. A few years later, a wildcat driller obtained a lease on a small farm located in the same valley and within a quarter mile or less of our mine well. Before he started drilling operations he was cautioned about the possibility of draining our upper well field. He misunderstood the situation and proceeded to drill a 10 in. rock hole through to the floor of the coal mine. In this 10 in. hole he set a 6 in. casing, sealing it off at the bottom of the mine. The water table in our upper well field dropped about 40 feet virtually overnight, as the water had the entire annular space between the 6 in. casing and the 10 in. rock hole to flow downward into the mine. Fortunately the driller was cooperative; his gas well was a good producer and he did not want to lose it. His log of the formations encountered was accurate. After inspection of the log we determined that the only formation encountered between our upper well field and the mine which would bore true enough and smooth enough to accept a mechanical packer was 5 feet of limestone at about 190-foot depth. Based on his logs, we inserted an 8 in. casing with welded joints around his 6 in. casing with an expansion packer located in the string of casing (which reached clear to the floor of the mine), and expanded it in the 5-foot limestone formation. This is illustrated in Fig. 10. The work was successful and sealed off the bulk of the flow down the well. Such a job would not be permanent. It was necessary to thoroughly cement off the rock hole down to the mechanical packer. This was done, as illustrated in Fig. 11, by introducing neat cement grout through a ½ in. pipe extending down to the top of the packer. This was the largest tremie pipe which could be inserted in the annular space. Using extreme care to insure uniform mixture of one-to-one neat cement grout, screening it so that there were no lumps, and introducing it at a uniform and constant rate, we were able to place some 218 bags of cement, filling the annular space to ground level.

Since that time we have closely watched other leases in the area, advising drillers that they must construct wells to a point below the mine in accordance with specifications we have set up. These specifications would avoid loss of water from the upper formation into the mine or loss of water from the mine into the deeper gas well. To date, interested drillers have abandoned their efforts after discussion of the problem with our local management.



Shades of Baltimore—and Elsewhere

There seems to be a foaming epidemic affecting activated sludge plants country-wide. Elsewhere in this issue is an article dealing with foaming difficulties at Baltimore, Md. Now comes in the accompanying picture of an Ohio plant (name withheld upon request) showing the foaming conditions there. We see no reason for the secrecy, because the foam epidemic appears to be widespread. New York City has been studying methods of foam suppression for some months and others have been doing the same. So far we have not heard of a wholly practical corrective.

The problem is—the more air the more foam; the less air the lower the degree of treatment. Modern soapless detergents are seemingly responsible for the foam difficulties.

The most objectionable part of such foaming is the fact that the suds are laden with aeration tank solids. The wind smears the foam all over the concrete work and surrounding landscape. As the operator of the plant here pictured says—In addition to the slimy mess all over the plant and surrounding grounds there is the unholy odor from the decomposing solids and the slipping hazard to operators. In addition our evergreen planting is turning up its toes. There must be an answer! But, if there is we haven't heard of it. We'd be pleased to hear from any operator who has licked the foaming problem, in part even if not in whole. Why this problem hasn't been discussed more openly in sewage association meetings during 1951 is puzzling.

Needed: Ceiling on Taxation!

Hard to believe, but the total tax burden (federal, state and local) on the people of this country has increased from $3,140,000,000 in 1916 to $52,000,000,000 in 1951. This increase of $48,000,000,000 in the tax take amounts to some 1556%—inflation of the rankest sort. Isn't it time for someone to say "Halt!"

A WATER & SEWAGE Digest

Toxic Plankton

by THEODORE A. OLSON, *Associate Professor, School of Public Health, University of Minnesota, Minneapolis, Minn.*

ON February 11, 1878, George Francis of Adelaide, Australia, in writing a letter to the editor of the weekly science journal, *Nature*, described accurately and for the first time the phenomenon which is now commonly referred to as "toxic algae" poisoning or "water bloom" poisoning. This letter, reproduced later in the May 2, 1878, issue of *Nature*, describes the low water level and the high temperatures which prevailed that year in Lake Alexandrina and mentions the heavy bloom of algae which preceded and existed concurrently with the observed loss of domestic animals along the shores of this lake.

"Being very light, it floats on the water except during breezes, when it becomes diffused. Thus floating, it is wafted to the lee shores, and forming a thick scum like green oil paint, some two to six inches thick, and as thick and pasty as porridge, it is swallowed by cattle when drinking. . . . This acts poisonously, and rapidly causes death; symptoms—stupor and unconsciousness, falling and remaining quiet, as if asleep, unless touched, when convulsions come on, with head and neck drawn back by rigid spasm, which subsides before death. Time—sheep, from one to six or eight hours; horses, eight to twenty-four hours; dogs, four to five hours; pigs, three or four hours."

A personal communication of January 1950 from Ivan L. Ophel, University of Oklahoma, is almost a sequel to the report of Francis. Ophel, whose original home is Adelaide, Australia, had the opportunity to observe Lake Alexandrina while doing plankton research along the River Murray. He states:

". . . in the early 1940's flood control locks were built across the estuary mouth which prevented the entrance of tidal waters into the estuary. This resulted in the water in Lake Alexandrina becoming less and less saline.

"In the summer of 1945 reports were received from the lake district that sheep and cattle were dying after drinking the lake water. Investigation disclosed that the lake, particularly near the shore, was covered with a dense scum several inches thick of blue-green algae. The floating mass had a grassy odor such that the animals actually appeared to graze on the algae!"

In the literature there have been references to similar losses of livestock and domestic animals. These reports have come from the United States, Canada, South Africa, and South America, indicating that toxic algae are world-wide in their distribution. During the last three years, six authentic instances of algae poisoning in Minnesota have been investigated by our research staff.

Laboratory Studies of the Toxic Material

The toxicity of the crude, unpurified algae material as collected in the field varies tremendously. In certain instances, quantities of 0.02 ml. or less injected intraperitoneally may be fatal to 20 gram mice in an hour, whereas other samples must be injected in quantities of 2.0 to 3.0 ml. to produce death in eighteen hours. When the algae are fed by mouth, a greater dosage must be administered and the effects are delayed. For example, a 10 ml. intraperitoneal injection of an extremely toxic algal sample killed a full grown chicken within twenty minutes. By mouth, 50 ml. of the same alga were lethal within one and one-half hours. Such results may be expected, for many toxic substances would act in a similar manner. With time, the toxicity of a given algal bloom may change in the field. Thus samples collected in exactly the same area at Fox Lake, Minnesota, were extremely toxic on September 19 when 0.1 ml. or less killed mice within twenty minutes, while nine days later, 2.0 ml., also administered intraperitoneally, killed animals only after five hours.

Although progress is being made in the isolation and separation of the toxic elements from the algae, the nature of the substance or substances which may be concerned has not been accurately determined. It would appear that more than one substance is involved and that the symptoms produced are a result of the combined action of these elements. In general, the crude toxic principle has the following characteristics: it can exist outside the cells in the water around the algae; it passes through cellophane and animal membranes by dialysis; it is non-volatile; it is relatively heat stable, losing no appreciable amount of its toxicity in dry preparations subjected to 100° C. for one hundred hours, or in wet samples autoclaved at 15 lbs. for one and one-half hours; it is soluble in water, alcohol (95% or less), and acetone, but not in benzene, ether, or chloroform; it is resistant to extreme pH changes; specific tests for cyanide, nitrate, nitrite, pilocarpine, saponins, Legal's test for cardiac glycosides, and specific extraction procedures for pilocarpine and strychnous alkaloids have all been negative.

Attempts to culture blue-green algae in the laboratory were at first made with the hope that a supply of toxic material could thus be made available for study at any time and in any quantity desired, and to determine whether or not laboratory-reared algae would be toxic. Heavy growths of algae entirely comparable to the blooms observed in the field have been produced in the laboratory. These cultures have repeatedly been tested for toxicity, and it has been found that their potency may vary considerably, the lethal dose for a 20 gram mouse, for instance, ranging from 13 to 68 mg. It has been found, however, that laboratory-produced cultures are not a practical source of raw materials, for extremely large quantities of toxic algae are needed and these can most economically be obtained from lakes where winds have concentrated the material in a natural way.

Toxic Algae in Relation to the Health of Man

Since surface water is the only source of water supply available to a large proportion of the world's population, it can readily be understood that the presence at any time of toxic agents in lakes or streams serving as a source of drinking water is a matter of great concern and constitutes a public health problem. The information at hand indicates that blue-green algae may be toxic to all types of warm blooded animals and birds, and that they are possibly toxic to fish as well. There is no reason to believe

This paper was presented at the 1951 Inservice Training Course in Water Works Problems at the University of Michigan School of Public Health.

that man is resistant—on the contrary, there is actually some evidence that we may already have seen certain manifestations of the effect of the toxin upon man.

During the drouth years, 1930 to 1931, for instance, outstanding difficulties were experienced in water supplies along the Ohio and Potomac Rivers and their watersheds. In West Virginia, Tisdale reported temporary intestinal disturbances involving between five and eight thousand people at Charleston. Several other cities also had gastroenteric outbreaks which, on the basis of epidemiological evidence, appeared to be water-borne.

The reports of both Veldee and Tisdale pointed out that in all instances the finished water supplied to the consumer met the approved bacterial standards and it was therefore unlikely that the epidemics were a result of bacterial infection of the water. Two theories were offered: one, that it was an "intestinal influenza," the other, that there was actually an enterotoxic substance in the water which had been derived from the decomposing organic matter. Because of the drouth, rivers were very low that year and the water was very warm. Extensive algal growths were consequently produced and such blooms, it was observed, usually preceded or occurred concurrently with the outbreaks of gastroenteritis which were reported.

In the discussion of the Charleston episode, specific mention is made of the trouble caused by blue-green algae and the measures taken for their control. An algae bloom was also present in the Anacostia reservoir when a dysentery outbreak occurred in the area outside Washington, D. C., served by that system. Tisdale, in discussing the intestinal disorders, states: ". . . it may be that algae in heavy concentrations with the resulting organic load may be a factor in bringing about these troubles." He does not, however, refer to a specific algae-produced poison. Inasmuch as it had been observed that the toxic agent can occur if shallow wells tap a water bearing stratum in low lying areas where the underground flow is derived from an algae-laden body of water lying at a higher level.

It is possible that through food as well as water man's health may be affected by toxic algae, for algae poisoning may be involved in producing the syndrome known as Haff's disease which has been reported in Europe. It is estimated that over one thousand cases were involved in the first two outbreaks. The disease occurred along the shores of Koenigsberg Haff in East Prussia for the first time during the last half of 1924 and the first half of 1925, and again in the autumn of 1932 and in the first month of 1933. In 1940 another smaller epidemic occurred, followed in 1948 by an outbreak of eleven cases around Lake Ymsen in Sweden. The disease is characterized by a sudden acute attack involving intense muscle pain, myoglobinuria, and sometimes vomiting. It is always associated with the consumption of fish or fish livers, even though these have been thoroughly cooked. Although several ingenious explanations have been suggested, none has been fully adequate, and the etiology of Haff's disease is therefore still unknown.

It is of interest to note that the lakes from which toxic fish have been taken produce heavy blooms of algae, and that in certain instances, the dominant species occurring during such bloom periods are identical with those associated with algae poisoning in the United States. It seems possible that directly or indirectly fish may have acquired a toxic agent from the water or from the algae and that these have become concentrated in the liver or the flesh. Available evidence does not permit definite reference to algae as the cause of the disease but does arouse suspicion, especially in view of the claim made by one writer that the scum formed along the shore of one of these lakes, when injected in animals, produced toxic manifestations which were comparable to those seen when similar animals were fed fish involved in an outbreak of Haff's disease.

Removal or Neutralization of Toxin Found in Water

Tests by Wheeler and his associates at Cincinnati (1942) indicate that the toxic agent associated with growths of *Microcystis aeruginosa (Polycystis aeruginosa)* will survive the laboratory equivalent of a water purification process consisting of alum coagulation, filtration, and chlorination. Activated carbon in small amounts corresponding to that actually used in water treatment was not effective, although large amounts made the effluent nontoxic to mice in 1.0 ml. dosages (1.25 ml. was the original lethal dose). Experiments carried on by us have demonstrated survival of toxins even after massive treatment with Norite A.

Related Problems

Organisms other than the fresh water planktonic blue-green algae are known to be toxic, and no discussion of toxic plankton could be complete unless one mentioned dinoflagellate poisoning. Since man is usually affected as a result of eating mussels, this toxication is most frequently referred to as mussel poisoning. The organisms ultimately responsible are *Gonyaulax catanella* on the Pacific Coast, *Gonyaulax tamercusis* along the North Atlantic Coast, and probably other species in other areas of the world. Mussel poisoning has been known for more than one hundred years in Europe. Along the Pacific Coast these dinoflagellates may occur in concentrations as high as forty millions per liter, and constitute the marine equivalent of a fresh water algal bloom. It is reported that on such occasions the sea turns red for miles and presents a ". . . beautiful luminescent spectacle at night." This is known as a red water period or a red tide. Shellfish and other plankton feeders consume large quantities of the toxic microorganisms during a red tide and concentrate the poisonous principle in their digestive glands or liver, although at times other tissues such as the gills are also highly toxic.

Sommer and Meyer (1941) state that there were three hundred and forty-six cases and twenty-four deaths from this cause in the period 1927 to 1941. To protect the public during periods when red tides can be expected, mussel quarantine orders prohibiting the harvest of susceptible shellfish from dangerous areas are issued by the California State Board of Health.

Within our experience it has been noted that ducks and shore birds are frequent victims when outbreaks of algae poisoning occur. These observations have led to a careful consideration of the literature and first hand reports of the phenomenon known as "duck sickness." This malady, affecting not only ducks but also many other groups of wild birds is today recognized as an outstanding menace to migratory waterfowl in the western and upper midwestern states as well as Canada. In late 1932, one hundred and fifty thousand ducks were found dead near the north end of Great Salt Lake on the south shore of Willard Spur and in the adjacent Bear River Bay area. In one instance, ducks were found along the shore at the rate of eight thousand to ten thousand per mile for a distance of six to eight miles. The cause has variously been attributed to industrial waste pollution, lead poisoning, gases, bacterial infection, parasites, dietary deficiency, alkali toxicity, and to toxic algae. In 1934 all causes other than poisoning by the toxin of *Clostridium botulinum* Type C were relegated to the background by the findings reported by

Kalmbach and Gunderson that year.

More recently certain areas have been found where the outbreaks are not always clearly attributable to botulinus C poisoning. During the past summer toxic algae were found in one of these areas (Whitewater Lake, Manitoba) at a time when a minor outbreak of duck sickness was occurring. The algae, when injected into mice, produced symptoms typical of algae poisoning. Limited studies relating to this problem are now under way in our laboratory and it is hoped that the work will throw additional light on our main project relative to the nature of algae toxins which affect larger animals and probably man.

Mono and Dichloramine Determinations in Water

A reply by D. B. Williams to A. T. Palin*

The writer is indeed pleased that Dr. Palin has commented on his recent paper.* Written replies and comments appear to be very much the proper thing in British journals dealing with water works practice, something that is to a large extent lacking in our American publications devoted to the same field. For the benefit of those of us in the Americas who do not read the *Journal of the Institution of Water Engineers* the writer gives assurance that the perusal of a few copies of that Journal gives ample indication that Dr. Palin is an outstanding leader in British Water Works practice particularly as it applies to various treatment procedures. It is trusted that Dr. Palin will not object to this rather impromptu introduction to the American field and it is given the hope that we may hear more of him and from him. His suggestion of greater progress through interchange of ideas and information will fall on approving ears here on this continent.

Since reviewing the paper under discussion, which has been published in the *Journal of the Institution of Water Engineering*, the writer has had no reason to change his opinions. Despite the briefness of the footnote the improved technic to overcome temperature troubles was tried extensively but to no greater avail. The possibility exists that the trouble may not be entirely due to temperature but rather a combination of high summer temperature with high protein content, it being recalled that at Brantford the raw water is at times virtually an organic soup. For this reason the writer has verbally and in writing suggested to the appropriate committee that both the Palin Method and the Amperometric Differential Titration be included in provisional methods of the forthcoming edition of "Standard Methods" so that more widespread use of both procedures under all types of conditions would assure more rapid progress in this field.

Conditions imposed by a highly polluted river are such that samples even of our finished water form an emulsion with carbon tetrachloride (ccl_4) which does not readily separate, making difficult in our case the relatively simple separation procedure described by Dr. Palin. The writer agrees that in research it is important to estimate the nitrogen tri-chloride (NCl_3) content but in plant operation the question is—is it detectable by odor? From bitter experience the writer can say that very small amounts of this gas are just as annoying as for greater amounts.

The writer assures Dr. Palin that NCl_3 generation has been far more than merely disconcerting in a number of plants in North America, not the least of these being the Brantford plant. From what the writer has read NCl_3 has apparently been no great problem in the British Isles to date. Due to being forced to treat waters here in America that even Dr. Palin's colleague Mr. Norman Pugh would consider unthinkable it is not surprising to witness our greater numbers of experiences with NCl_3 troubles.

In regard to NCl_3 the writer would refer Dr. Palin to (1) Griffin, A.E. "Chlorine for Ammonia Removal"—Proc. 5th Ann. Water Conf. of the Engrs. Soc. West. Pa. (1944). (2) Williams, D. B. "A New Method of Odor Control" *Jour. AWWA* 41:441 (1949) and (3) Williams, D. B. "Organic Nitrogen" *Jour. AWWA*, October, 1951.

In conclusion, the writer applauds Dr. Palin's crusade against "acid orthotolidine" of "Standard Methods" and follows in his path of desiring to see it superseded by more appropriate methods.

*Commentary by A. T. Palin, of Newcastle, Eng., in the Jan. 1952 issue of this magazine (p. 25) on the article "Mono and Dichloramine Determinations in Water" by D. B. Williams—W. & S.W. Oct. 1951.

Walter Spencer, Appointed Member of Licensing Board

Walter Spencer, superintendent and engineer, Merchantville-Pennsauken (N.J.) Water Commission, has been appointed to serve as a member of the New Jersey Board Examiners for the licensing of superintendents and operators of Water and Sewage plants or systems. The Board of Examiners consists of three water works operators, three sewage works operators, three engineers for the N.J. Dept. of Health.

Mr. Spencer holds the highest grade license as an operator or superintendent of a water system and treatment plant. For 28 years he has served as secretary of the South Jersey Assn. of Water Superintendents and is a trustee of the N. J. section of A.W.W.A. He is a member of the Am. Public Health Assn.; the Soc. Military Engrs.; Pa. Water Works Operator's Assn., and other professional groups.

In New Jersey Walter is known as "Spark-plug" Spencer, which moniker he rightfully deserves. In Feb. 1919 he became assistant superintendent of the Merchantville Water Co. and was held on in this capacity when the municipality bought the company's system in 1926. In Jan. 1949 he became superintendent succeeding Joseph Campbell, deceased.

Hazen and Sawyer Partnership

Richard Hazen, Consulting Engineer, and Alfred W. Sawyer, also a former Associate, Malcolm Pirnie Engineers, have announced the formation of a partnership for the practice of engineering.

The new firm will handle Investigations, Design, Supervision of Construction and Operation, of Water Supply, Purification, Distribution, Sewage Works and Industrial Waste Disposal.

Offices are located at 110 East 42nd Street, New York 17, N. Y.

Corrosion of Buried Metals

British Symposium Surveys Corrosion Problems—
Replacement of Water Mains Most Costly
Says Iron and Steel Research Association

THE symposium on the corrosion of buried metals held by the Iron and Steel Institute in conjunction with the British Iron and Steel Research Association and the Corrosion Group of the Society of Chemical Industry in London on December 12th, 1951, with Sir Charles Goodeve, F.R.S. in the chair, was attended by 300 people. Opening the symposium Sir Charles Goodeve said that all modern civilised communities were dependent on a number of services carried in the ground, water, gas, electricity and sewage being the chief. Water mains presented the greatest corrosion problems; some 100,000 miles were estimated to be under risk in this country in 1949, with another 25,000 miles of new mains under consideration.

Research on the corrosion of buried metals had lagged behind the advances in knowledge of methods of combating atmospheric corrosion, and the report of the Ministry of Health Departmental Committee on the Deterioration of Cast Iron and Spun Iron Pipes, published in 1950, had stressed the need for further research. B.I.S.R.A.'s Sub Committee on the Corrosion of Buried Metals had been formed in March, 1950 and was entrusted by the Minister of Health with the task of carrying out the research recommended in the Departmental Committee's report. The Sub Committee included representation of all the interests concerned—gas, water, engineering, non-ferrous metals, pipe manufacturers, etc., under the Chairmanship of Mr. L. C. Whiskin, Distribution Engineer of the Metropolitan Water Board and registered a very satisfactory degree of co-ordination of the interests concerned.

One of the Sub-Committee's earliest actions had been to initiate the organisation of this symposium. The six papers presented constituted a general survey of existing knowledge on the subject:

"Tests on the Corrosion of Buried Iron and Steel Pipes"—by J. C. Hudson and G. P. Acock.

"Investigations on Underground Corrosion"—by K. R. Butlin, W. H. J. Vernon and L. C. Whiskin.

"Cathodic Protection"—by K. A. Spencer.

"Cathodic Protection of Buried Metal Structures"—by R. de Brouwer.

"Corrosion of Buried Copper and Ferrous Strip in Natural and Salted Soils"—by the British Electrical and Allied Industries Research Association.

"Tests on the Corrosion of Buried Aluminium, Copper and Lead"—by P. T. Gilbert and F. C. Porter.

Discussion of these papers was to be taken in three sessions, each pair of papers was to be taken for discussion successively.

The first two and the last two papers were essentially the work of Research Associations or Laboratories (the Iron and Steel, the Electrical and Non-Ferrous Metals Research Associations and the Chemical Research Laboratory). In some of these researches valuable collaboration had been received from other organizations such as the Institution of Water Engineers and the Metropolitan Water Board. The other two papers were concerned with cathodic protection, a method which would undoubtedly be of very great importance in the future.

Buried Iron and Steel Pipes

Dr. J. C. Hudson, Head of the Corrosion Laboratory of the British Iron and Steel Research Association, gave a brief survey of the events leading to the research described in the first paper, and Mr. Acock described the interim results it contains. Three sets of steel and cast iron specimens covering a wide range of bare and coated ferrous pipes, had been buried in four typical British soils in 1944, and a fifth set in made-up ground. The soils at the five sites were salt marsh, London clay, moist neutral clay, Keuper marl and cinders respectively. The first set from the four and the single set from the fifth station had been examined after 5 years' burial. For bare pipes differences in the aggressiveness of the soil were more important than differences in the material of the pipes. It appeared that differences that had been reported in the resistance to corrosion of spun- and vertically-cast iron pipes had been rather due to differences in wall thickness than to any other factor, the former type of pipe being up to one third thinner for equal mechanical properties.

While it was too early to draw firm conclusions from the behaviour of the various coatings, it might be observed that a zinc coating of 2 ounces per foot protected the specimens over the five years except in made-up ground of ashes where corrosion was heavy. A ¼ in. thick bitumen coating on steel tube was almost perfect at this site, but a thin hot-dipped coal-tar-pitch coating, 5 mils thick, on cast-iron pipe had failed. Protected specimens were removed from only one other site, in the Keuper Marl, where the bitumen coating was intact but the coal-tar-pitch coating showed signs of failure. Vitreous enamel on cast-iron was in perfect condition at this site, but a stoved phenolic-resin coating on steel had failed because of its thinness.

Role of Bacteria in Corrosion

Dr. W. H. J. Vernon, O.B.E., Head of the Corrosion Group of the Chemical Research Laboratory (D.S.I.R.) introduced the paper "Investigations on Underground Corrosion" by K. R. Butlin, W. H. J. Vernon and L. C. Whiskin. The first part of the paper recapitulated the work carried out at the Chemical Research Laboratory on sulphate-reducing bacteria from 1934 onwards, which confirmed the conclusions of Dutch investigators on the part played by *Vibrio desulphuricans* in causing anaerobic corrosion of iron and steel pipes in neutral, waterlogged soils.

£50,000,000 DOWN THE DRAIN

- *The yearly cost of replacing corroded underground pipeline in Great Britain is estimated to be fifty thousand pounds.*
- *Microbiological causes of corrosion may have been overemphasized —this is merely a special type of electrochemical corrosion.*
- *But a very great majority of pipeline failures show unmistakable symptoms of microbiological influences.*

Fundamental studies of the bacteria, their morphology, culture and inhibition were continuing, and progress had been made. For example, it had been discovered that selenates prevented sulphates from being reduced, and this might be applicable in protective coatings. Field investigations in collaboration with the Institution of Water Engineers showed that corrosion associated with sulphate-reducing bacteria was the most widespread and dangerous form of underground corrosion.

The second part of the paper described experiments on the protection of ferrous pipes at Chigwell made in collaboration with the Metropolitan Water Board. In similar conditions to those obtaining at Chigwell microbiological corrosion had been known to occur within 12 months and commonly within 10 years. Large-scale tests were therefore begun there with various types of protection when new mains were laid in 1945. Almost three years after laying the main was examined. The portion protected with a standard 0.005 in. hot-dip coal tar enamel bath (the Angus Smith solution) was badly graphitised as shown in Fig. 1. Bitumen sheathing $\frac{1}{8}$ in. thick, however, gave adequate protection, as did surrounds of good quality concrete or gravel. Further trials were now in progress here and at Willesden.

Microbiological corrosion of pipe having standard coating after 3 years burial at Chipwell.

Discussion

DR. W. F. HIGGINS (Magnesium Elektron Ltd.) questioned the value of tests using short lengths of pipe. The service pipe, passing through various soils, would corrode only in cases where it became anodic. It was significant that the specimens shown by Dr. Vernon, cut from long length of buried pipe were much more severely corroded than Dr. Hudson's specimens which had been buried as short lengths. Dr. Hudson's specimens might give an indication of the behaviour of iron and steel when buried under the conditions he described but would not afford an indication of the behaviour of pipelines. A most important remark in Mr. Acock's address was that it appeared the nature of the ground was of greater consequence than the type of metal.

MR. W. G. WAITE (Magnesium Elektron Ltd.) supported Dr. Higgin's contention. Tests, he thought should operate under the same conditions that an average engineer had to face. In a length of pipeline large concentration cells would often form, and only tests in a long trench could provide information of circumstances such as these. Another point was that long lengths of pipe were frequently not perfectly buried in the bottom of the trench, and sometimes air pockets between the pipe and the soil would afford some protection from corrosion. He also thought that a point had been missed in not measuring the conductivity of the ambient electrolyte.

Mr. Waite thought that perhaps too much stress had recently been laid on the part played by bacteria in corrosion and more stress should be laid on the cell mechanism that led to it. Discussing the protective coatings tested at the Chemical Research Laboratory he commented that a hot dipped coating was permeable and would break down if once rusting started; but it would remain useful for a long time if rust could be prevented from starting. Bitumen was very vulnerable to damage by stones; concrete surrounds lacked flexibility and raised the danger of concentration cells again. Gravel needed good and consistent drainage to be effective and in fact usually became choked. He expressed surprise that no attempt had been made to test cathodic protection at Chigwell.

THE CHAIRMAN commented that the problem of using large scale or small scale tests occurred in many branches of scientific work. Account must be taken of the fact that accuracy of measurement fell off as the scale of the work was increased from the small scientific test towards the test under practical conditions; the cost also rose. There was frequently an optimum point where economy of effort, accuracy of measurement and correspondence to practical conditions most nearly coincided.

MR. N. J. PUGH (Corporation Water Undertaking, Coventry) spoke for the user of pipes and joined in the criticism of the tests on short lengths which, he said, could hardly indicate service conditions, nor could they indicate the internal stresses caused by the pressure of fluctuation and he urged that tests should be carried out in close co-operation with the user. On the question of the economy of such tests he had heard a figure of £5 million quoted for replacement costs of buried pipes and he thought that £10 million would probably be nearer the mark. He thought that the academic causes of corrosion were less important than a study of the way to

day pipes so protected that corrosion would not occur.

DR. F. WORMWELL (Chemical Research Laboratory) described the work continuing at the C.R.L. in this direction. He said that many pipes submitted by water undertakings were examined and reported on, some undertakings using the standard form supplied for this purpose and some submitting their specimens independently. In this way the Laboratory maintained close touch with the engineers facing practical problems. Work in the Laboratory included electrochemical measurements which might throw light on the behaviour of bacteria.

MR. E. W. RAWLINGS (Semtex Ltd.) commented on the protection which cement mixtures could afford. Latex cement which could be sprayed on to pipes had been successful when used in conjunction with hessian or glass cloth to reduce mechanical damage when laying or back filling.

MR. J. G. PARRY (Fibreglass Ltd.) referred to the standards laid down and used by the Dutch. He thought that in this country much applied and practical work was not put into the hands of the engineer.

MR. F. E. WARNER (Carless, Capel & Leonard Ltd.) reported his firm's experience with large underground structures such as storage tanks. These were used for storing petroleum and coal tar distillates and as a safeguard against outflow in case of perforation were surrounded with 6 inches of puddled clay. This had been the practice for at least 60 years and in spite of the sites being waterlogged, tanks of this age or older were still in use, and were not corroded seriously on the outside when excavated. Of course, some of the really old tanks might be iron, not steel. Corrosion of the type shown had been found after about 15 years with the connecting pipelines buried in soil about 2 feet down. It might be that these had become anodic and protected the tanks.

Replying to the discussion DR. VERNON said that the tests involving short lengths of pipe did not fail to take account of experiences with longer lengths in the field. Co-operation with actual users was an essential feature of the work, and every possible step had been taken to co-operate with water and gas engineers as could be seen from the standard form which was being widely used to report corrosion failures of buried pipes. The figure of £10 million replacement costs given by Mr. Pugh was itself an underestimate and the latest estimate was in the neighbourhood of £50 million.

He agreed that there had been a tendency to overemphasize the microbiological causes of corrosion and he and his colleagues had taken every opportunity of pointing out that microbiological corrosion was not basically different from electrochemical corrosion of which it was merely a special type. However, it should be pointed that the very great majority of pipeline failures in this country had been associated with unmistakable symptoms of microbiological influences.

MR. L. C. WHISKIN (Metropolitan Water Board) said that the tests at Chigwell were carried out in one continuous trench and the pipes were laid in accordance with normal main laying practice. Cathodic protection was not included in the tests as five years ago this practice was not so well known and was, indeed, regarded with some suspicion. He admitted that now more information was available he wished that such protection had been installed.

He said that the Sub-Committee on the Corrosion of Buried Metals was now concentrating more on methods of prevention than on the causes of corrosion. In this connection he emphasized, in the case of main-laying, the importance of taking every care in the transport and handling of pipes and in the back filling of trenches in order to avoid damage to coatings; the Report of the Departmental Committee of the Ministry of Health on the Deterioration of Cast Iron and Spun Iron Pipes published in 1950 contained much useful information on the subject.

Cathodic Protection Methods

MR. K. A. SPENCER of the Anglo-Iranian Oil Co. Ltd. introduced both his own paper and that by MONSIEUR R. DE BROUWER, who was unfortunately prevented from attending. Mr. Spencer said that it was now generally appreciated that a properly designed cathodic protection installation would protect a buried steel structure indefinitely. Corrosion of a buried or submerged structure was generally the result of one or more of four causes:

(a) the concentration-cell effect, occurring where changes in the concentration of soluble salts in the soil along the length of a pipe line, would cause the areas of higher concentration to become anodic. This was the principal cause of pipe line corrosion in the Middle East.

(b) the electrolytic-cell effect, caused by stray direct currents resulting in a variation in the potential of a buried pipe line relative to the soil.

(c) the galvanic-cell effect, caused by contact between dissimilar metals.

(d) the bacterial corrosion in anaerobic conditions, which was the chief cause of underground corrosion in the United Kingdom. Sulphate reducing bacteria accelerate corrosion from this cause by removing hydrogen on polarisation.

Whatever the cause, the corrosion of metals was associated with a positive electrical current flow from the metal to the electrolyte at the anode—the point of corrosion. Cathodic protection was based on the simple conception that if sufficient electrical current was flowing uniformly into the metal surface from the electrolyte, the flow from the anode was stifled and corrosion did not take place. Cathodic protection could, therefore, be prevented by providing a flow of current either from a higher potential scrap-metal groundbed anode supplied with an external direct current, or from expendable metal anodes such as magnesium, aluminum or zinc, having a higher electrode potential than steel. In this case current was produced as in a "dry-battery."

Mr. Spencer said that to ensure protection a current of between 1 and 15 m. amp. per sq. ft. of exposed metal was usually necessary. Hence the need for good and continuous coatings, which were complementary to cathodic methods. The potential between metal and electrolyte had to be assessed, and this could conveniently be measured by a high resistance voltmeter with a copper to copper-sulphate half-cell. Natural potentials were usually from —0.35 to —0.70 volts. It had been found that if more than —0.85 volts was maintained, by application of cathodic protection, full protection was provided.

It was also necessary to survey the soil before applying cathodic protection; the most convenient method was to measure its electrical resistance. A broad designation was:—

Very corrosive—Less than 500 ohms per c.c.
Corrosive—500-2000 ohms per c.c.
Mildly corrosive—2500 ohms per c.c.

Where soil resistivities were very high the potential developed by sacrificial anodes was not sufficient and the power-supplied system had to be used.

Mr. Spencer briefly described sacrificial and power-supplied installations, and quoted examples where considerable economies had been effected. Cathodic protection was finding increasing application to oil, gas and water lines, tank bottoms, jetties, wa-

ter tanks, ships' hulls, process plant and buried power-transmission lines.

Mr. Spencer then introduced Monsieur de Brouwer's paper "Cathodic Protection of Buried Metal Structures." Monsieur de Brouwer is the Technical Manager of the Societe de Distribution du Gaz, Brussels. The paper deals with cathodic protection by "polarised drainage" and "forced drainage". These methods had been extensively used on the Continent, where there were many tramways and railway lines using direct current, the presence of which complicated the practical installation of cathodic protection.

"Polarised drainage" consisted of the neutralisation of anodic areas caused by stray currents leaving the structure, by recourse to connecting the pipeline to the return circuits of the electrical traction lines from which the stray currents originated. The drainage apparatus had to be large enough to resist inverse potentials of the order of a score of volts or so and to allow the flow of several hundreds of amperes without producing large potential drops.

"Forced drainage" was applied where the potential of the rail did not constitute a sufficient source of current and it was not necessary to insert in the electric circuit a supplementary source of E.M.F. Practical applications of both methods were described in both papers.

Discussion

The subject of the measurement of soil potentials excited considerable comment in the discussion on these papers. Dr. A. J. Maurin (Gaz de France, Paris) distinguished between specific aggressivity and apparent aggressivity over the length of a pipeline. Nomograms had been constructed for calculating specific aggressivity from characteristics of the soil which could easily be measured. No main was laid in France today without both the specific and apparent aggressivity of the soil having been ascertained. Some 600 kilometres of new mains were being protected every year. They were considering the use of ultrasonics to combat the sulphate reducing bacteria.

Mr. J. H. Gosden (British Electricity Authority) also emphasized the value of measuring potential in assessing the danger of corrosion. This was important where power cables were concerned as corrosion was often confined to areas where the conditions were particularly severe, as, for example, where they were subjected to stray currents from traction systems. Mr. Gosden gave details of potential measurement at a substation where corrosion of lead covered and served cables had been caused both by stray currents from an adjacent traction system and by electrolytic action. The tests showed that the potential between the cable and the soil was the factor which controlled the rate of corrosion.

Mr. W. Westwood (British Cast Iron Research Association) raised a practical point in measuring potentials. He asked Mr. Spencer where he put the copper sulphate half-cell when he was carrying out his measurements. If it was put in the soil above the magnesium anode, it gave a greater reading than if it were placed vertically above the pipe which in turn gave a greater reading than if it were placed in remote earth. Mr. Westwood mentioned that one must not forget that there were very many miles of water pipes that did not corrode, nor was corrosion always the cause of failure. Ground movements caused failures sometimes though subsequent corrosion might appear on a casual examination to have been the primary cause.

Mr. J. R. Walters (General Post Office) commented that the necessary cathodic potential "drifted" with time due to polarisation and actually the current required tended to become less.

Mr. H. C. S. Hayes (General Post Office) said that the Post Office had some 35,000 miles of main trunk cable and in 1950 about 1,000 sheath faults occurred on these due to corrosion and 3,000 more on shorter cables. 45 per cent of 6,000 exchange areas covering the country had been affected by corrosion at one time or another. Practically all the cables were bare lead in earthenware pipes and only about 5 per cent of the total cable mileage had a protective covering and the lead sheath. The series resistance of the lead sheath per mile for bare cable in earthenware ducts was about one-half to five ohms depending on the cable size and the resistance to earth depended upon the wetness of the ducts but normally was of about the same order. When hessian tape and compound covering was used over the lead, as was sometimes done in areas subject to corrosion (other than in areas where there were tramways), the insulation to earth, although comparatively low, of the order of from two ohms to one hundred ohms per mile, was sufficient to provide the Post Office with complete protection and there had been only one or two cases of failure and these were where the protection had been damaged mechanically. This was a relatively expensive method, however, and it was thought that cathodic protection might cut costs. Cathodic protection had been tried in seven exchange areas, one of them in Lavington in Wiltshire where since connecting it up in 1946 no faults had occurred. Previously for some years sheath faults had averaged two per year. The other six cases were not so conclusive but did encourage further investigation.

Another installation of cathodic protection was commented on by Mr. C. W. Marshall (British Electricity Authority) who expressed admiration of the way the Belgians had made a large number of commercial installations "instead of only writing reports". An example of the way they used the most economic methods available was between the Schelle Power Station and Antwerp where 16 kilometres of power cable operating at 70,000 volts passed through very aggressive soil. Since 1938 complete immunity from corrosion failure had been achieved by the use of cathodic protection.

Mr. C. W. N. McGowan (Kuwait Oil Co. Ltd.) described a cathodic protection installation on jetty piling in the Persian Gulf.

Mr. J. Ferdinand Kayser (Gillette Industries Ltd.) said that cathodic protection was applicable not only to buried metals but to parts of prime movers, chemical plant, fine instruments and the like. It was possible that on occasion parts of a machine or instrument might be fortuitously in a state of cathodic protection; a safety razor holder made from aluminum did, for instance, protect the razor edge from visible corrosion, but such protection apparently tended to alter the physical properties of the metal in the vicinity to the edge. Cathodic protection could be used completely to protect the edge from rust, but if one unduly increased the protecting current the edge would then wear away at a rate roughly proportional to the current density. He could not envisage cathodic corrosion of steel and would like to ask if either of the authors had found any evidence that the physical properties of cathodically protected metals were adversely affected. He thought this an important consideration, because in a seaplane a ferrous part might be fortuitously cathodically protected and show no signs of rust, yet its physical properties might deteriorate to such an extent that failure might occur.

Dr. Vernon said that the alkali deposit might play a part in precipi-

tating protective deposits. This might be what happened at the razor's edge, though he thought it dangerous to extrapolate from there to a buried pipeline!

Replying to the discussion, MR. SPENCER said that he thought that Mr. Marshall underrated the extent of work completed in this country and the Middle East. There was a considerable amount of work on cathodic protection going on. So many variables entered into the planning of protection schemes that trial and error was a necessary procedure in many cases. Replying to Mr. Westwood's question about the half-cell he said that he advocated placing it as near the pipe as possible. In connection with Mr. Walter's point of reducing the potential, he thought that the saving was so small in relation to the capital cost that it was scarcely worth considering.

Tests of Buried Strips and Tubes

The paper contributed by the British Electrical and Allied Industries Research Association on "Corrosion of Buried Copper and Ferrous Strip in Natural and Salted Soils" was introduced by DR. G. MOLE. The paper described an investigation to determine the relative corrodibility in different soils of metals used for earth electrodes. Over a period of 12 years the behaviour of cast iron, Armco iron, mild steel, galvanized mild steel, copper and tinned copper in 12 soils were investigated. As the soil surrounding electrodes is often salted as an anti-corrosion precaution, salted and unsalted soils were used at each site.

It was found that tinned copper was the most corrosion resistant, usually losing by corrosion less than 0.1 per cent per year, compared with nearly 2 per cent for unprotected ferrous specimens. Galvanising, however, gave mild steel considerable protection, which lasted at least 12 years. Salting generally increased the corrosivity of the soils.

"Tests on the Corrosion of Buried Aluminum, Copper and Lead" by P. T. GILBERT and F. C. PORTER was introduced by Mr. Porter. He described tests on tubes of commercial-purity aluminum, phosphorus-deoxidised arsenical copper, and lead buried at the same time and on the same sites as the ferrous specimens referred to in the first paper. As iron and steel pipes were most commonly used for mains and non-ferrous metal pipes for supply lines, the two investigations were deliberately undertaken in parallel. The aluminum was severely pitted after 5 years in all soils except the moist neutral clay, where there was virtually no attack. Cinders caused severe attack on copper and in the other four soils the attack varied from practically nothing to a moderate localised attack up to about 0.2 mm. deep (about 10 per cent of the wall thickness of a 16 S.W.G. pipe) in five years. Lead was unattacked in one soil and moderately attacked in the other four with maximum depths of attack between about 0.5 and 1.0 mm. (7 to 15 per cent of a $\frac{1}{16}$-in. wall thickness) in five years. Lead behaved comparatively well in the cinders. It was worth remarking that they had encountered variation of corrosivity along the length of the trench by a factor of two.

Discussion

DR. F. A. CHAMPION (British Aluminum Co. Ltd.) questioned whether the results had been presented in the best possible way. He would have preferred a simple plot of corrosion against time which might reveal that the corrosion effect was considerable in the first year, decreasing in subsequent years more in salted than in unsalted soils. Dealing with the second paper he referred to the breakdown of the protective oxide film on aluminum at three sites, he suggested that the sulphate and chloride explanation was insufficient and further attention should be paid to copper contamination. He was interested by the suggestion of puddled clay protection and thought that this might be applicable with aluminum, especially if the clay was puddled over the bitumen to barium chromate type of protective coating which was giving promising results in soil corrosion tests by his colleagues.

MR. GOSDEN found it hard to draw firm general conclusions before correlation of the nature of the soil and the amount of corrosion was possible. The results did indicate that copper earthing strips would be suitable in most natural soils and that aluminum needed a more permanent covering to be used underground.

Of 130,000 miles of buried cable belonging to the British Electricity Authority most had some sort of protection. The standard was 2 bitumenised paper tapes, 2 bitumenised cotton tapes and one bitumenised hessian tape. These were quite good against chemical attack, though not so good against stray currents in which armouring was necessary between the cotton tapes and the hessian. There had been 100 faults due to corrosion in 1949-50, that is to say, 0.08 per year per 100 miles. Of these, 63 faults had been due to electrolytic attack and of this number, 29 were due to stray currents; 27 were due to chemical attacks of which five had been accounted for by local contamination and most of the others by aggressive soil. The causes of 16 corrosion failures were unknown.

MR. J. B. COTTON (Imperial Chemical Industries Ltd.) thought that, from the weight loss figures quoted in the paper, the order of merit in which tinned copper appeared to be superior to bare copper might be misleading, particularly if the results were too widely interpreted. No assessment of pitting had been made and he doubted whether one could accept the general usefulness of tinned copper for underground use in spite of the good showing in the test. He would not like to see tinned copper pipes used underground. He queried the general usefulness of the tests for the particular application under discussion since the work had not involved the application of impressed current to the specimens.

MR. R. E. A. LIDDIARD (Fulmer Research Institute) regretted the attribution of the paper to the Electrical Research Association, instead of to individual authors. He thought that the best way of using aluminum underground would be by protecting cathodically with some suitable cladding such as the aluminum to zinc coatings that were being used in the U.S.A.

MR. R. L. DAVIES (British Insulated Callenders Cables Ltd.) suggested that aluminum might not be trustworthy in anaerobic conditions. When immersed in distilled water, boiled and sealed with paraffin, the aluminum gave off hydrogen after four weeks and began to corrode. The access of oxygen would appear to be an important factor. When tested similarly in a nitrate solution, the aluminum specimens after a period of a few days to a few weeks began to dissolve very rapidly, the nitrate having turned to ammonia. Could this not happen when aluminum was buried in soil?

Replying, Dr. G. Mole agreed with Mr. Cotton that care should be exercised in applying his results to pipes since pitting was of no significance in earthing strip and had therefore been disregarded in these investigations. Dr. Gilbert said that Dr. Champion's suggestion of further investigation of copper contamination in the electrolyte when aluminum corroded would be pursued. The presence of chloride and sulphates was not necessarily detrimental, but breakdown would be more rapid in the presence of chloride.

Cathodic Protection of Steel Underground

A RECENT study[1] by the National Bureau of Standards provides a better understanding of the mechanism of cathodic protection as an important method of inhibiting underground corrosion.

By eliminating uncertainties inherent in field measurements, NBS was able to determine an optimum protective potential on a firm scientific basis. The value arrived at (—0.77 volt) was confirmed by weight-loss measurements on electrodes maintained at the selected potential in five different corrosive soils.

Corrosion Largely Electrolytic

Normal corrosion of iron and steel underground is largely an electrolytic or galvanic phenomenon. When iron is exposed to the soil, local differences in electrical potential develop at the surface of the metal, resulting in the formation of numerous small corrosion cells. This means that electric currents flow through the soil or water from certain areas (anodes) to areas of less negative potential (cathodes), with accompanying loss of metal from the anodes and evolution of hydrogen at the cathodes. When cathodic protection is applied, direct current from an external source is caused to flow counterwise through the soil from an auxiliary anode *toward* the corroding surface. This applied current causes the cathode potentials to approach the anode potentials, and thus check the flow of currents from the pipe or other metallic body and into the surrounding medium—soil or water.

The question of the potential at which an underground or submerged structure should be maintained in order to inhibit corrosion is of considerable interest. Insufficient potential will give inadequate protection.

When the potential of a cathodically protected underground or submerged structure is measured by engineers in the field, an indefinite IR (voltage) drop is ordinarily included in the measurement. The magnitude of this drop at a given value of current naturally depends upon the conductivity of the soil or water and the position of the reference electrode used in making the measurement. Corrosion circuits are complex, and there is no general agreement among engineers as to where the reference electrode should be located. A measured value of —0.85 volt (referred to a standard copper-copper sulfate electrode) is generally accepted by engineers as the optimum protective value. Yet because the amount of IR (voltage) drop is not ordinarily known, identical readings of —0.85 volt obtained by engineers at different installations are not likely to indicate the protective potential free of undesired IR drop.

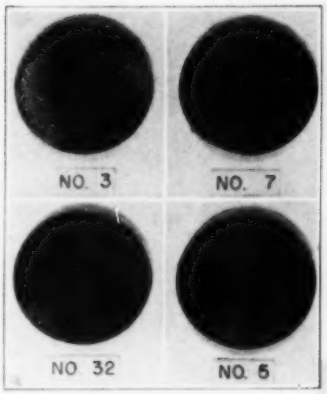
Determining Optimum Potential

These uncertainties were eliminated in the NBS laboratory in arriving at the value of —0.77 volt referred to a saturated calomel electrode. Since this value corresponds approximately to —0.85 volt referred to the copper-copper sulfate electrode, the NBS work confirms the practice of cathodic-protection engineers for the special condition when all IR drop is eliminated except that which is included in the field of the normal corrosion circuits.

To arrive at the optimum protective potential for steel in soils, the potentials of steel electrodes were measured at NBS in 20 air-free soils, ranging from very acid (pH 2.9) to very alkaline (pH 9.6). Potentials were plotted against the pH values of the soils. The resulting curve intersected the potential curve for the standard hydrogen electrode at a pH of approximately 9.0 and a potential of —0.77 volt (referred to a saturated calomel electrode). At more negative potentials iron becomes cathodic to the hydrogen electrode and corrosion therefore ceases.

Confirmation

To confirm experimentally the effectiveness of a —0.77 volt protective potential, weighed steel electrodes were exposed to five soils in specially designed corrosion cells. After 2 days without protective current, the electrodes were maintained at —0.77 volt for 60 days. By making potential measurements with an electronic interrupter in conjunction with a potentiometric measuring circuit, all IR drop external to the boundary of the corrosion circuit was eliminated. Weight lost during the test by the electrodes maintained at —0.77 volt was negligible compared with weight losses of control electrodes that received no current. Electrodes allowed to deviate for relatively short periods to potentials less negative than —0.77 volt lost appreciable weight.



Corrosion Test Specimens After 60 Day Exposure

Upper specimens without cathodic protection. Lower specimens maintained at protective potential of —0.77 volt. The two on left were exposed to very acid soil (pH 2.9); the two on right to very alkaline soil (pH 9.5)

The current required to maintain a —0.77 volt protective potential is not uniform. With most of the soils tested the necessary current diminished to a fairly stable value after about three weeks. These minimum values of current needed to maintain the protective potential differed for different soils, and were approximately equal to the average corrosion currents calculated from the weight losses of the control (unprotected) electrodes.

It was possible to estimate the minimum protective current initially required for cathodic protection in a particular soil by preliminary measurements. Electrode potentials were measured as increasing values of current were applied. The potential-current curve given by these measurements has a characteristic change-in-slope at a certain current value, above which the potential changes more rapidly. The current indicated by the change-in-slope was taken to be the minimum value initially required for effective protection. This current when constantly applied caused the electrode potential to drift to the protective value (—0.77 volt) in from 3 to 21 days as alkali accumulated on the electrode surface.

Prior to disassembling the corrosion cells, the protected electrodes were left without protective current for about 15 hours, after which a curve relating potential to applied current was again obtained. This time the change-in-slope typical of corroding metals was no longer evident. This was taken as a further indication of the effectiveness of the protection against corrosion furnished by the —0.77 volt protective potential.

[1] "Potential and Current Requirements for the Cathodic Protection of Steel in Soils," W. J. Schwerdtfeger and O. N. McDorman, J. Research NBS 47, 104 (1951).

This is NOT the Sierra Blanca Range!
Behind this Mountain (of Foam) Lies Baltimore's Sewage Treatment Plant

Detergents in Sewage - Baltimore's Experience

Analyses from Back River Sewage Treatment Works Provide First Data on Concentration and Removal of New Sewage Constituent

by C. E. KEEFER, *Deputy Sewerage Engineer, Baltimore, Md.*

Editorial Associate

ALTHOUGH numerous studies have been made in this country and abroad to determine the effect of synthetic detergents on sewage treatment processes, there is little published data on the detergent content of raw and treated sewage. Perhaps one reason for the lack of information on this subject is that many of the laboratories at sewage-treatment plants are not equipped to determine the detergent content of sewage.

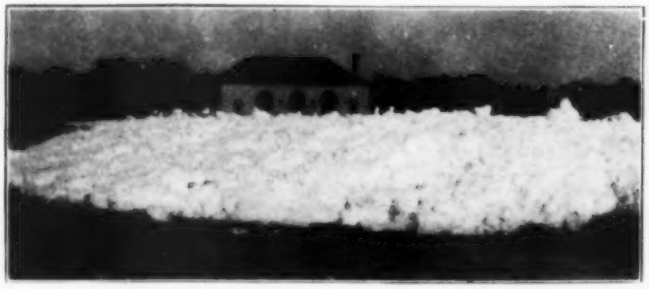
Evans and Winsor[1] have reported on the apparent concentration of detergents in raw sewage at ten English cities. With the exception of two of these cities, where the concentration was as high as 10.6 and 20.0 p.p.m., the amounts ranged from 0.95 to 5.6 p.p.m. These authors noted a reduction in detergents after treatment in primary settling tanks and also after trickling-filter and activated-sludge treatment. Apparent detergent concentrations of less than 1.0 p.p.m. were frequently observed in effluents which had received secondary treatment.

In discussing their experiments with synthetic detergents at Huddersfield, England, Goldthorpe and Nixon[2] state that the active principle of the anionic detergents in the sewage sampled by them varied from 5 to 10 p.p.m.

The detergent content of the raw and treated sewage at the Back River sewage-treatment plant was determined over a 5-day period from October 16 to 20, 1950. Samples were collected hourly and composited each 24 hours. The colormetric method as described by Jones[3] was used to determine the amount of detergents present. The results, which are presented in the accompanying table, are expressed in equivalents per million parts of sewage.

As there are undoubtedly a number of different equivalent weight sulfonated or sulfated surface active compounds in sewage, it is impossible to express accurately the results in parts per million. However, a rough idea of the concentration in parts per million can be determined by assuming that the surface active agents have an average equivalent weight of 300. Thus, sewage having concentration of surface active agents of 5.0×10^{-3} equivalents would have a parts per million concentration of $5.0 \times 10^{-3} \times 300$ or 1.5.

The raw sewage contained an average of 5.6×10^{-3} equivalents of sulfonated surface active compounds. There was a reduction in the concentration of these compounds in the primary settling tank effluent and the trickling-filter effluent with a concentration of 3.4×10^{-3} equivalents in the humus-tank effluent. If it is assumed that the average equivalent weight of these compounds is 300, the humus tank effluent contained approximately 1.0 p.p.m.



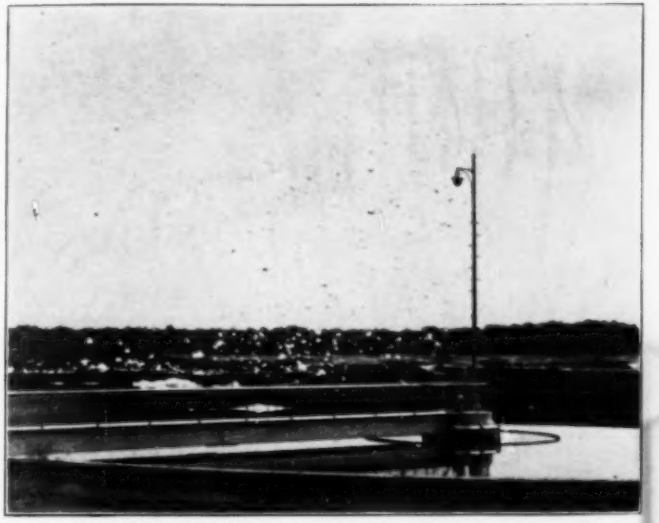
WIND-DRIFTED foam from the activated-sludge aeration tanks.

The activated-sludge aeration tank effluent contained 3.5 x 10^{-6} equivalents and the activated-sludge settling tank effluent 4.4 x 10^{-6} equivalents. No entirely satisfactory explanation for this increase in concentration is apparent. The amounts of detergent present are so small that the difficulty of obtaining truly representative samples of sewage may be the reason for the inconsistent results.

The removal of detergents by primary settling was about 14 per cent, by primary settling, trickling filters and secondary settling about 39 per cent and by primary settling plus activated-sludge treatment about 21 per cent. These removals represent the results of a comparatively small series of analyses. It will be necessary to secure analyses over an extended period of time before satisfactory conclusions can be formulated as to the removal of detergents by the different treatment processes at the Back River plant.

The analyses indicate the amount of detergents in the Baltimore sewage is so small that they have no apparent detrimental effect on the treatment processes. The experiments of a number of investigators[1,2,3,4] suggest that there would have to be much larger amounts before any deterioration in the effluent would result. The most striking evidence of detergents in the sewage is the formation of foam in the activated-sludge areation tanks and at the terminal end of the effluent channel from the humus tanks.

The Back River sewage-treatment plant is under the general supervision of P. L. Holland, director of public works, with John J. Hunt, sewerage engineer. Dr. Abel Wolman is consultant to the department of public works.



FOUNTAIN OF FOAM carried from aeration tanks to final clarifiers.

DETERGENTS IN RAW AND TREATED SEWAGE
BACK RIVER SEWAGE-TREATMENT WORKS, BALTIMORE, MD.
(Each of the values given x 10^{-6} equals equivalents of sulfonated surface compounds per million parts of sewage.)

Date 1950	Raw Sewage	Primary Tank Effluent	Trickling Filter Effluent	Humus Tank Effluent	Aeration Tank Effluent	Activated-sludge Settling Tank Effluent
Oct. 16	5.5	3.5	4.5	3.4	3.2	5.0
17	6.8	4.5	3.6	2.9	3.4	3.2
18	5.4	5.8	4.7	5.0	4.7	4.8
19	5.0	4.5	3.4	3.1	3.4	5.0
20	5.5	5.8	3.6	2.7	3.0	4.0
Average	5.6	4.8	4.0	3.4	3.5	4.4

References:
1. Evans, H. C. and Winsor, P. A. "Processing of Sewage Containing Wool Scouring Liquors." *Jour. and Proc.*, Inst. of Sewage Purif., Part 3, 365 (1949).
2. Goldthorpe, H. H. and Nixon J. "Further Experiments with Synthetic Detergents at Huddersfield Particularly with Respect to Their Action on Percolating Beds." *Jour. Royal San. Inst. 70, 2,* 116 (1950).
3. Jones, J. H. "General Colorimetric Method for Determination of Small Quantities of Sulfonated or Sulfated Surface Active Compounds." *Jour.*, Assoc. Official Agricultural Chemists, *28,* 398 (May, 1945).
4. Rudolfs, W., Manganelli, R. and Gellman, I. "Effect of Certain Detergents on Sewage Treatment." *Sew. Works Jour., 21,* 605 (1949).
5. Sciver, A. "Sedimentation of Sewage." *Jour. and Proc.*, Inst. of Sew. Purif., Part 3, p. 354 (1949).
6. Degens, Jr., P. N., Van der Zee, H., Kommer, J. D. and Kamphuis, A. H. "Production of Methane from Sewage Sludge." *Jour. and Proc.*, Inst. of Sew. Purif., Part 3, p. 359 (1949).
7. Hurley, J. "Influence of Synthetic Detergents on Sewage Treatment." *Surveyor,* 109, 393 & 405 (July 7 & 14, 1950).
8. Waddams, A. L. "Synthetic Detergents and Sewage Processing." *Jour. and Proc.*, Inst. of Sewage Purif., Part 1, p. 32 (1950).

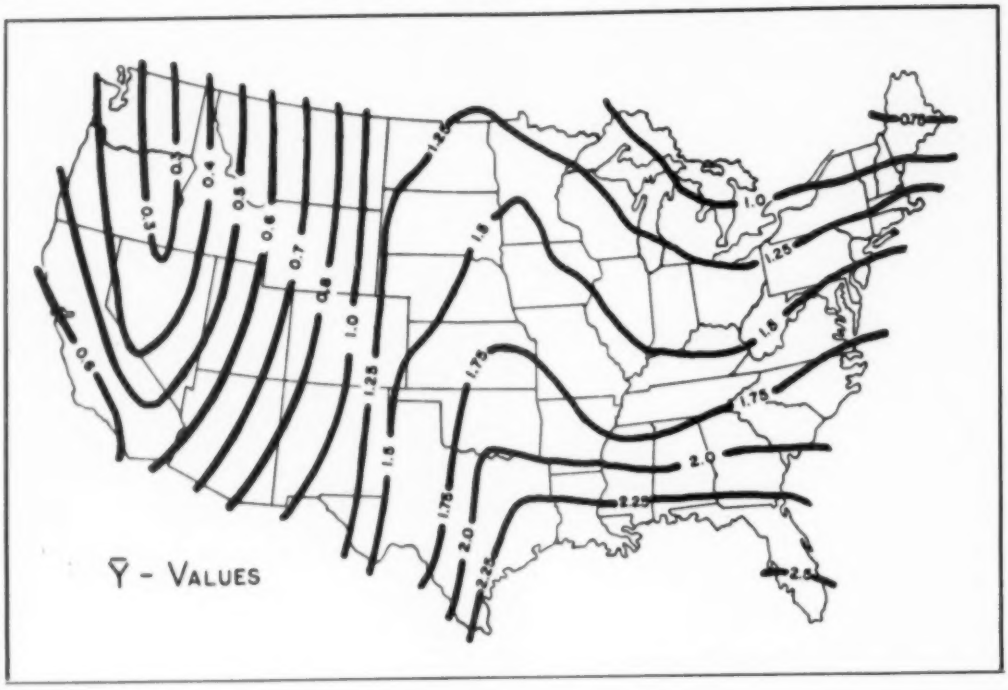
Five Year Improvement Program of Atlanta Waterworks

Paul Weir, manager of the Atlanta, Ga., water works, has blueprinted a $10 million expansion and improvement program, and the City Council is slated to appropriate the first million of a five-year $5 million program. It is planned to finance an additional $3.1 million collateral program from water works certificates. A projected purification plant may be financed in the same manner, within the next three or four years.

Approximately 133 miles of water mains must be laid in the city's new Seventh, Eighth, and Ninth Wards within the next five years. These will be from 6 to 20 inches in diameter. Water bills in this newly annexed area will be reduced by half because consumers are no longer non-residents. This will cost the treasury about $400,000 a year, but normal increase from new water services exceeds that amount and no loss in revenue is expected for 1952.

Under the new program, the first improvements will extend water mains two miles beyond the present city limits each year, until this work is finished in five years. A new 25-mile long main from the treatment plant to an outlying industrial area would increase pressure and volume, and bring the prospect of a reduction in fire insurance rates to all sections of the new Atlanta.

At present, the water system is valued at $40 million, and from $1.0 to $1.5 million is being added each year in improvements. Half of the expenditures in the new program are for improved fire protection. Weir considers a more adequate volume of water supply and higher pressures essential to obtaining lower insurance rates.



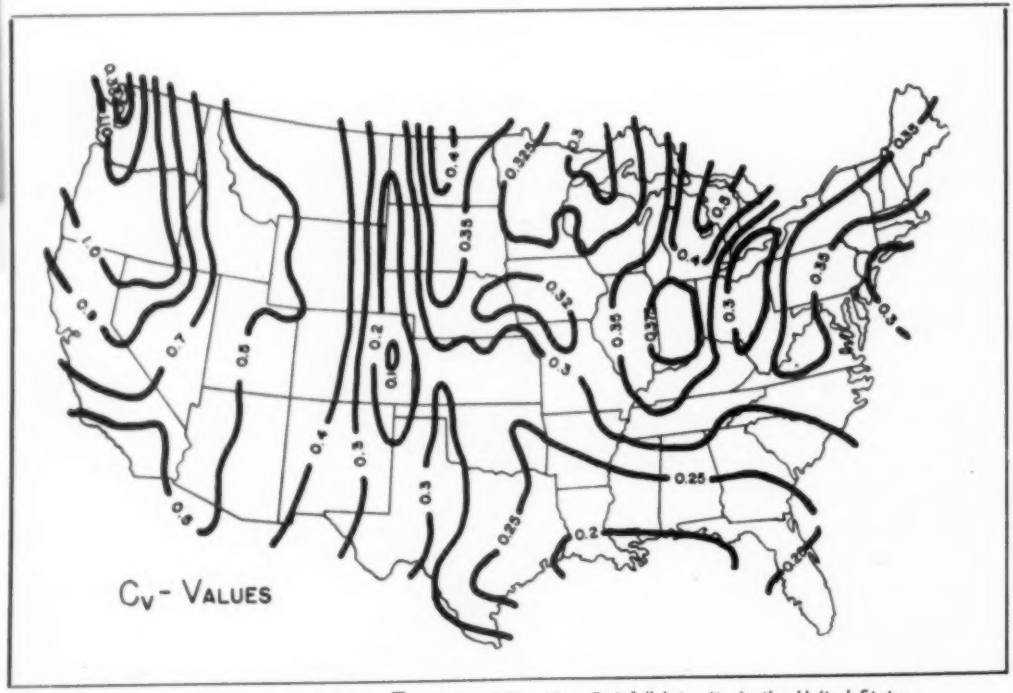


Fig. 1—The Characteristic Values, $\bar{Y}$ and C_v, of One-Hour Rainfall Intensity in the United States

Design Charts for Finding Rainfall Intensity Frequency

by VEN TE CHOW, *Dept. of Civil Engineering, Univ. of Illinois, Urbana, Ill.*

THE greatest need for information relating to rainfall frequencies is apparent in various economic studies and in the efficient design of sewerage systems, airfield drainages, farm terraces, highway and railway culverts, stream-control works, and many other hydraulic structures and projects which are designed in consideration of the frequency of certain rainfall intensities. The charts presented herein are found to be a very convenient and useful aid, especially for preliminary investigations and for investigations in areas where rainfall data necessary for a more exact analysis are not available.

The principle involved in the use of the charts is based on a formula developed by the author ("A General Formula for Hydrologic Frequency Analysis," Trans. Amer. Geophys. Union, Vol. 32, No. 2, pp. 231-237, April, 1951), which appears as follows:

$$y / \bar{y} = 1 + C_v K$$

in which $y/\bar{y}$ is the y-mean ratio or the ratio of the maximum rainfall intensity of a given frequency of T years to the mean rainfall intensity, C_v is the coefficient of variation or a statistical parameter characterizing the variability of rainfall intensities, and K is the frequency factor depending on the frequency T, or being a function of T.

Fig. 1 illustrates isohyetal maps of the characteristic values, $\bar{y}$ and C_v, for one-hour rainfall intensities. From these maps values of $\bar{y}$ and C_v at various places in the United States can be found or interpolated. The calculations required for the preparation of the given maps are based on published data ("Rainfall Intensity Frequency Data" by David L. Yarnell, Miscellaneous Publications, No. 204, U. S. Dept. Agr. 1935), which have proved of inestimable value for the purpose mentioned above, although local peculiarities in rainfall may not be fully represented, particularly in mountainous regions along the west coast.

Using a satisfactory theoretical function of T for K (Eq. 15 or Fig. 8 of the above mentioned paper in Trans. Amer. Geophys. Union), a set of curves can be prepared for the hydrologic frequency formula such as those of Fig. 2, in which the relations between $y/\bar{y}$ and C_v for various T from 2 to 100-years are represented.

A further study of Yarnell's data reveals the general relations among various rainfall intensities, durations and frequencies for a wide range of climatic regions. The relations are shown graphically in Fig. 3, in which the one-hour intensity is taken as an index. When one-hour rainfall intensity of a given frequency is known, the intensities for other durations of the same frequency can be easily determined from the graph.

As an example for use of the design charts, the rainfall intensity frequencies at Chicago, Illinois, may be found as follows:

(1) For one-hour rainfall intensity at Chicago, the characteristic values are found from Fig. 1 to be:

$$\bar{y} = 1.36 \text{ in. per hr.}$$
$$\text{and } C_v = 0.37$$

(2) From Fig. 2, the y-mean ratios for various frequencies corresponding to $C_v = 0.37$ are found and listed in Col. (2) of Table 1.

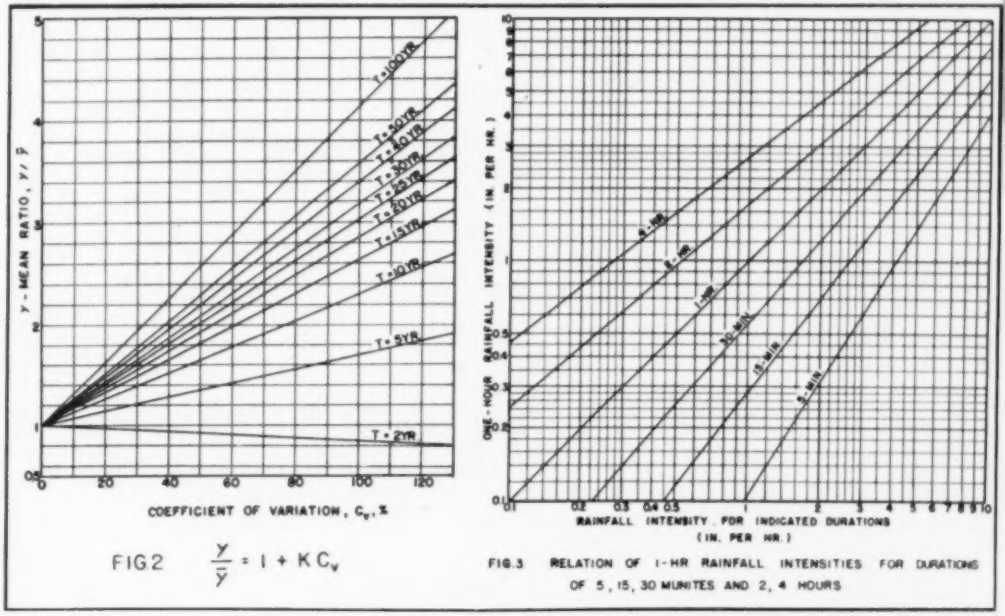


FIG. 2 $\frac{y}{\bar{y}} = 1 + K C_v$

FIG. 3 RELATION OF 1-HR RAINFALL INTENSITIES FOR DURATIONS OF 5, 15, 30 MINUTES AND 2, 4 HOURS

(3) Multiplying y-mean ratios by $\bar{y} = 1.36$ in. per hr., the one-hour rainfall intensities for various frequencies are obtained as given in Col. (3) of Table I.

(4) Referring to Fig. 3, the rainfall intensities for other durations of various frequencies are easily found and listed in the remaining columns of Table I.

The author is greatly indebted to Prof. J. J. Doland for kind advice received during the preparation of the design charts.

Table I.

COMPUTATION OF RAINFALL INTENSITIES FOR ASSIGNED FREQUENCIES

Location: Chicago, Illinois

$\bar{y} = 1.36$ in. per hr. $C_v = 0.37$

Frequency (T-years)	1-hr.		Rainfall Intensities for Durations of 5-min.	15-min.	30-min.	2-hr.	4-hr.
	(y/ ȳ)	(y)	(y in in. per hr.)				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2	0.94	1.28	4.75	3.22	2.10	0.70	0.38
5	1.27	1.73	5.80	4.00	2.71	0.97	0.56
10	1.48	2.01	6.45	4.48	3.10	1.19	0.66
25	1.75	2.38	7.15	5.15	3.60	1.48	0.85
50	1.96	2.67	7.65	5.60	4.00	1.65	0.96
100	2.16	2.94	8.20	6.00	4.40	1.90	1.12

Eugene Dugger is Dead

Longtime Superintendent of Water at Newport News, Va., was President of AWWA in 1938

Eugene Frank Dugger, who until retirement in November of 1951 was general manager of the Water Commission of Newport News, Va., died in Umatilla, Florida on December 29, just one month after his retirement caused by ill health. He was 53 years old and a past-president of the Am. Water Works Assn.

Mr. Dugger was born in Greenville, Tenn. June 25, 1898. He received his education in the public schools of Greenville and in Tusculum College. He was a member of the Am. Assn. of Civil Engrs. In World War I he served in the Army Air Force as a fighter pilot, where he became a close personal friend of the late General "Billy" Mitchell whose ghost must be hovering over an airforce such as he fought to get but was denied. His convictions on the importance of air power have since been proven so right.

After the war "Gene" Dugger joined the Newport News Light and Water Co. in June 1919 as assistant superintendent and promptly proved what he was made of. His reputation for progressive, sound planning won for him the managership of the water works system when the city purchased it in 1926. The newly organized water commission appointed "Gene" Dugger as General Manager and gave him free hand to run the show, which he did with great credit to himself and profit to Newport News. During his 25-year tenure the system was expanded and built into a property valued at more than three times its cost to the city which was $3,300,000. Under what may be termed city owned-private management the Water Department made money even in the depression years, paid off all bonded debts as they become due and cost the citizens of Newport News not a penny of taxes.

A civic leader "Gene" Dugger became president of several local civic groups including the Chamber of Commerce, for three terms, and the Rotary Club. He served his church (First Presbyterian) well as deacon and later elder. He took "for better or for worse" the charming Ruth Manville of Newport News, who was just as sterling as was "Gene".

Mr. Dugger was a member of the Masonic Lodge and Elks Club. He was director of the First Nat'l. Bank and secretary of the Mutual Home and Savings Assn. of Newport News. He was a charter member of the Peninsula Sportsman's Assn. and an avid duck hunter and fisherman. This explains why there was always good fishing to be had on the Newport News reservoirs.

As General Manager of the Newport News Water Commission "Gene" Dugger did a splendid public relations job, as evidenced by the nature and length of local editorials on the passing of "a city official so capable and relatively so young." Never in any political change was "Gene" Dugger or his Department a target; never was there ever any attempt to replace him or to drive a political wedge into the municipally owned water utility. Said one of the editorials on "Gene" Dugger—"He has built up in a quarter century a monument in the excellent municipal department that grew so sturdily under his management . . . which service has won for him a high place in any roster of the Peninsular's builders."

As in other organizations, he served so well, he was a charter member of the Va. Section of A.W.W.A. and became its first Chairman and first National Director. His fellow A.W.W.A. Directors early recognized "Gene" Dugger's ability and leadership, which led to his election as president of the Association in 1938. As a further recognition he received the Geo. W. Fuller Award in 1943 as a token of recognized leadership in the water works profession.

"Bill" Raisch Re-enters Consulting Field

William Raisch announces the opening of a consulting office in the Garden City Bldg., Garden City, L.I.

For some years, before his appointment as Chief Engr. for the Borough of Queens, New York City, Mr. Raisch was in the consulting field and maintained an office in New York City. His many friends will welcome him back in the field and wish him well.

Algae Fertilization Costly—Madison to Divert Effluent

The Madison, Wis., metropolitan Sewerage Commission has voted to comply with the State's order to divert effluent from the Monona, Waubesa, and Kegonsa Lakes. Discharge of sewage effluent has fertilized the growth of algae and has resulted in noxious conditions.

In 1941 the state legislature passed a law prohibiting the discharge of sewage effluent into a lake less than two square miles in area. Madison has fought the order for ten years, but the commission voted unanimously to comply when the law was upheld by the State Supreme Court.

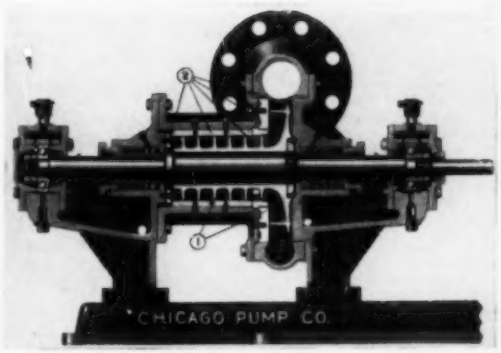
Preliminary estimates of the cost of effluent diversion range from 3 to 6 million dollars. The most frequently considered plan involves piping effluent from the treatment plant to the Yahara River below Lake Kegonsa.

Chicago Pumps for Sewage and Sludge

SCRU-PELLER SLUDGE PUMPS

The Scru-Peller Pump was specifically designed to handle sludge. Coarse stringy material is cut and cannot wrap or bind the impellers.

1. **SCREW and IMPELLER** are keyed on the shaft and held firmly against a shoulder on the shaft by a nut. The screw has two flights; and the impeller has two blades. Each flight in the conveyor connects directly with its own blade of the impeller.
2. **CUTTING EDGES.** There are four stellited cutting bars and a shear ring in the screw housing. There are four more cutting bars in the pump casing. The stellited edges of the screw and the edges of the impeller blades act against the cutting bars and shear ring, completely chopping all coarse solid material into small pieces that cannot clog or slow the pump.



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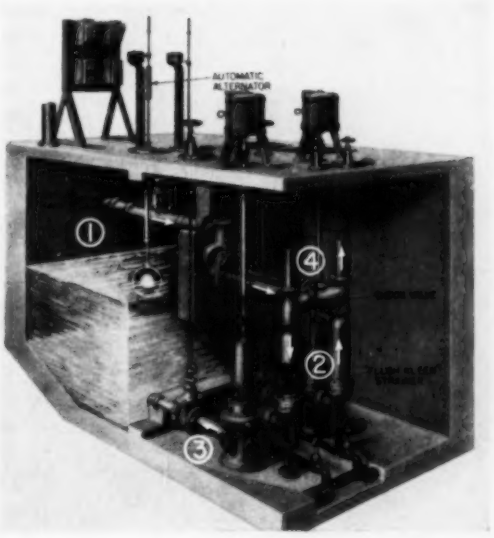
FILLING WET WELL

1. Sewage flows through inlet pipe.
2. Coarse matter is retained on strainer.
3. Strained sewage flows through idle pump to wet well.

PUMPING

3. Strained sewage is pumped from wet well.
2. Coarse matter is backwashed from strainer.
4. Special check valve closes; sewage and coarse matter are pumped to sewers.



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Meetings Scheduled

Feb. 12-13—Portland, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, Supt., Winthrop Water District, Winthrop, Me.

Feb. 13—Newark, N.J. *(Essex House)*
NEW JERSEY SECTION A.W.W.A. (Winter Luncheon Meeting). Sec'y, C. B. Tygert, Box 178, Newark, N. J.

Feb. 13-15—Indianapolis, Ind. *(Lincoln Hotel)*
INDIANA SECTION A.W.W.A. Sec'y, Geo. G. Fassnacht, 1330 W. Michigan St., Indianapolis 7, Ind.

Feb. 14—Boston, Mass. *(Hotel Statler)*
NEW ENGLAND WATER WORKS ASSOCIATION. (Monthly Meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Feb. 27-28—Chicago, Ill. *(Drake Hotel)*
AMERICAN CONCRETE PRESSURE PIPE ASSOCIATION. Mgn. Dir., Howard F. Peckworth, 228 N. LaSalle St., Chicago, Ill.

Feb. 28-Mar. 1—Chicago, Ill. *(Drake Hotel)*
AMERICAN CONCRETE PIPE ASSOCIATION. (44th Annual Convention.) Mgn. Dir., Howard F. Peckworth, 228 N. LaSalle St., Chicago, Ill.

Mar. 9-13—College Station, Texas *(Texas A. & M. College)*
TEXAS WATER & SEWAGE WORKS ASSOCIATION. Sec'y, V. M. Ehlers, 501 West 33rd St., Austin, Texas.

Mar. 12-14—Atlantic City, N. J. *(Traymore Hotel)*
NEW JERSEY SEWAGE & INDUSTRIAL WASTES ASSN. Sec'y, M. J. Kachorsky, P.O. Box 766, Manville, N.J.

Mar. 20—Boston, Mass. *(Hotel Statler)*
NEW ENGLAND WATER WORKS ASSOCIATION (Monthly Meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Mar. 20—Boston, Mass. *(Hotel Statler)*
NEW ENGLAND SECTION A.W.W.A. Sec'y, George E. Bogren, 14 Beacon St., Boston, Mass.

Mar. 24-26—Augusta, Ga. *(Bon Air Hotel)*
SOUTHEASTERN SECTION A.W.W.A. Sec'y, T. A. Kolb, State Board of Health, Wade Hampton Building, Columbia, S.C.

Mar. 26-28—Chicago, Ill. *(Hotel LaSalle)*
ILLINOIS SECTION A.W.W.A. Sec'y, J. L. Hart, 122 So. Michigan Ave., Chicago 3, Ill.

Apr. 3-5—Mesa, Arizona *(Maricopa Inn)*
ARIZONA SEWAGE & WATER WORKS ASSOCIATION (and) ARIZONA SECTION A.W.W.A. Sec'y, H. S. Jordan, State Dept. of Health, Phoenix, Ariz.

Apr. 7-9—Fayetteville, Ark. *(University of Arkansas, Eng. Bldg.)*
ARKANSAS WATER & SEWAGE CONFERENCE. Dr. Harrison Hale, Southern State College, Magnolia, Ark.

Apr. 10-12—Spartanburg, S.C. *(Clemson College)*
SOUTH CAROLINA WATER & SEWAGE WORKS ASSOCIATION. Sec'y, W. T. Linton, Wade Hamilton Bldg., Columbia, S.C.

Apr. 10—Billings, Mont. *(Northern Hotel)*
MONTANA SEWAGE & INDUSTRIAL WASTES ASSN. Sec'y, H. B. Foote, State Dept. of Health, Helena, Mont.

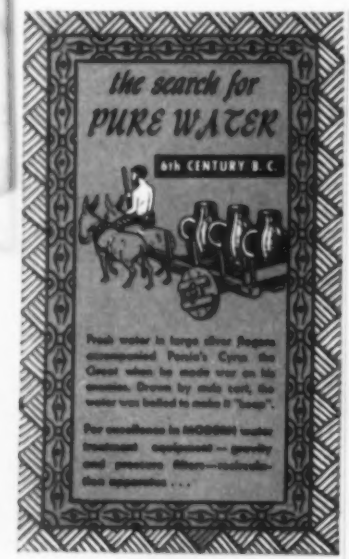
Apr. 11-12—Billings, Mont. *(Northern Hotel)*
MONTANA SECTION A.W.W.A. Sec'y, A. W. Clarkson, State Board of Health, Helena, Mont.

Apr. 16-18—Syracuse, N.Y. *(Hotel Syracuse)*
NEW YORK SECTION A.W.W.A. (Spring Meeting). Sec'y, R. K. Blanchard, 50 West 50th St., New York, N.Y.

Apr. 17-18—Lincoln, Neb. *(Cornhusker Hotel)*
NEBRASKA SECTION A.W.W.A. Sec'y, E. Bruce Meier, University of Nebraska, Lincoln, Neb.

Apr. 24-26—Spokane, Wash. *(Davenport Hotel)*
PACIFIC NORTHWEST SECTION A.W.W.A. Sec'y, O. P. Newman, Boise Water Corp., Boise, Idaho.

May 4-9—Kansas City, Mo. *(Municipal Auditorium)*
AMERICAN WATER WORKS ASSOCIATION (Annual Convention). Exec.-Sec'y, Harry E. Jordan, 521 Fifth Avenue, New York 17, N.Y.
(Accommodations in 14 hotels. Reservations through A.W.W.A. office.)



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For measuring, turbidity of water. Consists of cast aluminum housing, adjustable lamp . . . two vertical wells for holding two Nessler tubes.

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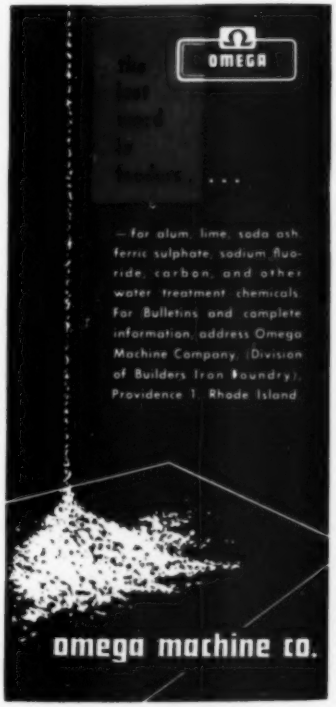
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May 12-13—Roanoke, Va. *(Hotel Roanoke)*
VIRGINIA INDUSTRIAL WASTES & SEWAGE WORKS ASSN. Sec'y, G. R. Talcott, 815 E. Franklin St., Richmond 19, Va.

May 21-23—Toledo, Ohio *(Commodore Perry Hotel)*
OHIO SEWAGE & INDUSTRIAL WASTES TREATMENT CONFERENCE. Sec'y, J. E. Richards, 301 Ohio Depts. Bldg., Columbus 15, Ohio.

May 26-28—Montreal, Canada *(Hotel Mt. Royal)*
CANADIAN SECTION A.W.W.A. Sec'y, Dr. A. E. Berry, Ontario Dept. of Health, Parliament Building, Toronto, Ont.

June 6—Auburn, Ala. *(Pitts Hotel)*
ALABAMA WATER & SEWAGE ASSOCIATION. Sec'y, Alex O. Taylor, Box 69, Alabama Polytechnic Institute, Auburn, Ala.

June 18-20—Erie, Pa. *(Lawrence Hotel)*
PENNSYLVANIA SECTION A.W.W.A. Sec'y, L. S. Morgan, State Dept. of Health, Greensburg, Pa.

Aug. 25-27—State College, Pa. *(Nittany Lion Inn)*
PENNSYLVANIA WATER WORKS OPERATORS ASSN. Sec'y, R. Rupert Kountz, Pennsylvania State College, State College, Pa.

Aug. 27-29—State College, Pa. *(Nittany Lion Inn)*
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSN. Sec'y, B. S. Bush, Dept. of Health, Kirby Health Center, Wilkes-Barre, Pa.

Sept. 3-5—Upper Saranac, N. Y. *(Saranac Inn)*
NEW YORK SECTION A.W.W.A. Sec'y, Rollo K. Blanchard, 50 West 50th St., New York, N.Y.

Sept. 8-10—Groton, Conn. *(Hotel Griswold)*
NEW ENGLAND WATER WORKS ASSOCIATION (Annual Meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Sept. 8-13—Chicago, Ill. *(Hotels to be announced)*
AMERICAN SOCIETY OF CIVIL ENGINEERS. (Centennial Celebration). Sec'y, Wm. N. Carey, 33 West 39th St., New York, N.Y.

Sept. 9-11—Grinnell, Iowa *(Grinnell College)*
IOWA SEWAGE WORKS ASSOCIATION. Sec'y, Leo Holtkamp, Box 310, Webster City, Iowa.

Sept. 15-17—Knoxville, Tenn. *(Andrew Johnson Hotel)*
KENTUCKY-TENNESSEE SECTION A.W.W.A. Sec'y, R. P. Farrell, Dept. of Public Health, 420—6th Ave., Nashville, Tenn.

Sept. 15—Cheyenne, Wyo. *(Frontier Hotel)*
ROCKY MOUNTAIN SEWAGE WORKS ASSOCIATION. Sec'y, C. E. Harness, 272 City & County Bldg., Denver, Colo.

Sept. 16-17—Cheyenne, Wyo. *(Frontier Hotel)*
ROCKY MOUNTAIN SECTION A.W.W.A. Sec'y, Geo. J. Turre, Box 600, Denver, Colo.

Sept. 18-19—Cincinnati, Ohio
OHIO SECTION A.W.W.A. Sec'y, F. P. Fischer, 812 Perry Payne Bldg., Cleveland 13, Ohio.

Sept. 21-23—Jefferson City, Mo.
MISSOURI SECTION A.W.W.A. Sec'y, W. A. Kramer, State Office Bldg., Jefferson City, Mo.

Sept. 24-26—Battle Creek, Mich. *(Post Tavern)*
MICHIGAN SECTION A.W.W.A. Sec'y, T. L. Vander Velde, Dept. of Health, Lansing 4, Mich.

Oct. 6-9—New York, N.Y. *(Statler Hotel)*
FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSOCIATIONS (Annual Meeting). Exec.-Sec'y, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill. (and)
NEW YORK SEWAGE & INDUSTRIAL WASTES ASSOCIATIONS. Sec'y, Ralph C. Sweeney, 21 N. Broadway, White Plains, N.Y.

Oct. 12-15—Tulsa, Okla. *(Mayo Hotel)*
SOUTHWEST SECTION A.W.W.A. Sec'y, L. A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

(Continued on page 108A)

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Nominal inside dia. of pipe, in.	Depth of joint, inches of Leadite	Approx. Lbs. of lead per joint	Depth of joint, inches of lead	Approx. lbs. of lead per joint
4	2.5	2.00	2.25	8.56
6	2.5	3.00	2.25	11.71
8	2.5	4.00	2.25	14.63
10	2.5	5.00	2.25	17.70
12	2.5	6.00	2.25	20.86
14	2.5	7.00	2.25	24.02
16	2.5	8.25	2.25	33.07
18	2.5	9.25	2.25	36.88
20	2.5	10.50	2.25	40.71
24	2.5	13.00	2.50	53.02
30	2.75	16.00	2.50	65.36
36	2.75	19.00	2.50	77.96
48	3.50	30.00	3.00	121.15
54	4.0	38.00	3.00	135.60
60	4.0	42.00	3.00	150.70

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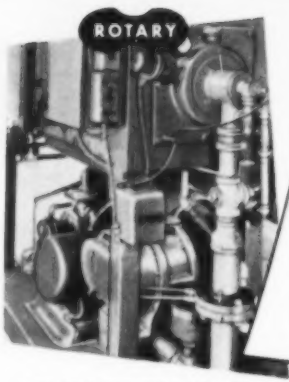

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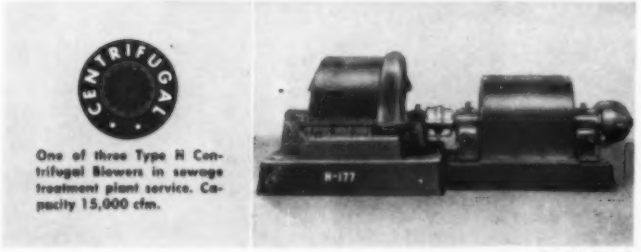

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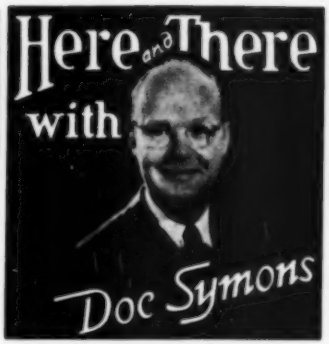

H.T.M.A.—Christmas is past and the New Year but a few hours away as I sit here in my attic, pondering what to say to you in my February letter. You certainly are not interested in my New Year's Resolutions—or what I got for Christmas, except one present, perhaps—but you are interested in the doings of some of your fellow beings, who also make clean water out of dirty—and vice versa, or in some way are concerned with those endeavors—as, aren't we all.—Well here goes —

* * *

That Christmas present—of which I am inordinately proud, is a membership card in "Editors Anonymous" of the Percolation and Runoff Section of the Jour. of AWWA. Two things I don't understand about this, however; the letter accompanying the card said it (the card) was digestible and had a licorice flavor, but I ate a corner and it tasted just like cardboard; the grade of member on my card also stumps me. It says "Deetee," which could only mean delirium tremens, couldn't it?

The card is signed by P & Ric, the Ric being "Ric" Johnson, Editor of the Journal, and the smoothest man I know for turning a neat phrase or putting words together to make them amusing. Once he wrote me a letter, wherein the parts; salutation, body, and signature composed a single four-line quatrain. Damn clever boy! And thanks, "Ric" for including me in that highly selective group of "Editors Anonymous."

While on the subject of Christmas I want to thank Art (Waukesha) Kuranz and George (Green Bay) Martin for that wonderful Wisconsin cheese of which I am so fond.

* * *

SMALL WORLD No. 15—For a number of years, I've seen Gladys Swope at Conventions of the Amer. Chem. Soc., the AWWA, and the Federation, where she has often partici-

pated as a speaker or officer, etc. Many persons remember her as longtime editor of the Abstracts in Sewage Works Journal.

One place I definitely had not expected to see her was on my television screen; but on Sept. 5, there she was on "New York Closeup," one of the best shows on television; a show which stars Tex and Jinx (Falkenberg) McCrary and features interviews with famous, interesting and outstanding personalities who live, work or visit in New York City. "Glad," who is now in atomic energy work at Argonne National Lab. in Chicago, was in N.Y.C. for the 75th Anniv. Convention of the Amer. Chem. Soc.—And there she was right on my television screen—Small World!

And speaking of TV, I watched the show on which Harold Stassen threw his hat into the ring for the Republican presidential nomination. —I swear I saw W. J. (Bill) Orchard in the audience.—How about that, Bill?—For myself, I still like Ike!

* * *

Before too much time passes since the meetings at State College, Pa. last August, I want to mention a couple of more things—

——Wednesday afternoon is an off-period between the water group and the sewage group. It is also the time when the local stores are closed as many of us found out when we went to do a little shopping. As my girl, Va., and I wandered down the almost empty streets, we found an art shop, which had some interesting lamps in the window. We also found that the store was full of customers.

We opened the door and—you guessed it, the customers were all wives of conventioneers. There was Ida (Mrs. Myron) Mansfield of Morris Knowles Engineers, Pittsburgh; Martha (Mrs. Hal) Hutton of Wallace and Tiernan, Newark; Mrs. Fred Leopold, of F. B. Leopold Co., Pittsburgh; and Mrs. Ed. Shriner of Simplex Valve and Meter Co., Philadelphia; and several others.

The poor shop keeper was flustered to think that he was doing business when he was supposed to be closed. One of the ladies (I'll bet it was Ida Mansfield) had seen someone inside, and had just walked up and opened the door, which the proprietor had forgotten to lock.—Never underestimate the power of a woman—with a dollar to spend!

——"Mel" (Mrs. Larry) McClung of the Dalecarlia Filter Plant in Washington, D. C. was wondering out loud, "What's the matter with Doc, he looks kinda peaked?"—Nothing, Mel, I was just getting

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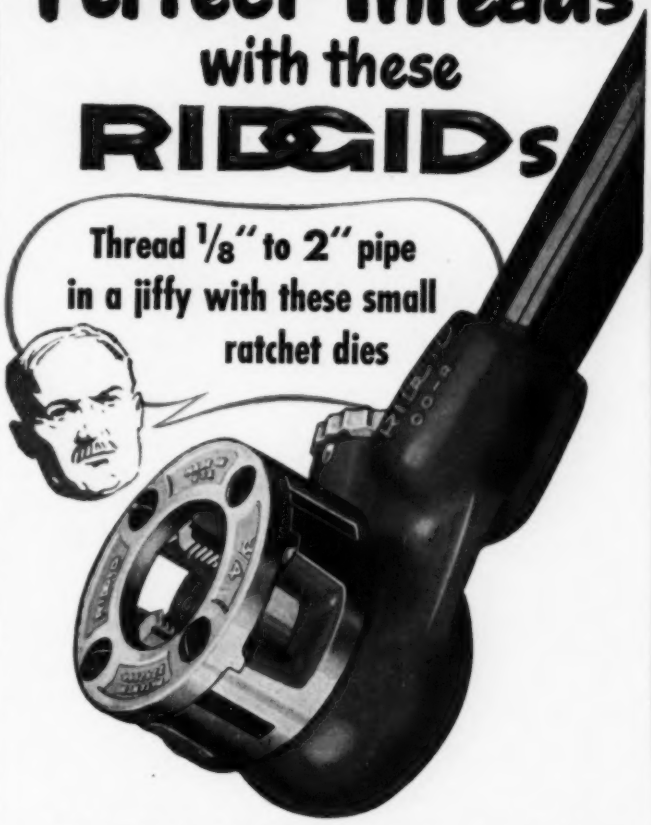

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down to my "fighting weight" once again after several years of making the convention circuit—and then too, I was contemplating my future as an independent consultant and free lance writer.

——One thing you can always count on at the annual dinner of the Pa. SWIA meeting, is the rendition of La Paloma by A. A. (Al) Estrada, one of Frank Friel's right hand men.—Al does a right fair job of warbling.

——At this year's meeting, I was quite impressed when Harry Beaumont, Philadelphia's Chief of Industrial Wastes was presented with the High Hat of the SLUDGE SHOVELERS' SOCIETY, in recognition of his fifty years as a TEMPORARY employee of the city of Philadelphia.

* * *

Once or twice in my career as a columnist, I have been taken to task for editorializing in this column—and for the most part I avoided the practice. Now that I am no longer a staff member of the magazine which prints this column, I hope that occasionally I can express a personal opinion, since it has no relation to the editorial policy of the magazine.

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Personally I'm "agin" things such as this—"Albany, N. Y. (AP)—The State Education Department has dropped questions on the germ theory of disease from the Regents examinations used by most of the state's public and parochial high schools. . . . such questions were eliminated after the 1950 Legislature enacted a law specifying that pupils could be excused from courses teaching principles contrary to their religious tenet . . . the law, affecting the disease control section of the health and hygiene course has been adopted in deference to Christian Scientists, who do not believe in the germ theory."

Now, never let it be said, that I'm against religious freedom, but the next step *could* be to legally prevent chlorination of water "in deference to persons who do not believe in the germ theory."—Are we heading for the dark ages again?

—Of course, I'm a little bit hepped on this particular subject—I can remember just before I entered the University of Illinois, a smallpox epidemic was caused by a non-believer in the germ or virus theory of disease. Fortunately, the Univ. of Illinois does believe in germs and virus and vaccination.

* * *

Mutual admiration Society—I've always thought, and said, that the *Sanitary Engineering News*, a single sheet periodical published by Purdue University and edited by Don E. Bloodgood, is one of the best sources of interesting information available. Recently, Prof. Bloodgood, in his *Sanitary Engineering News*, said that he liked *The Courier* of B-I-F Industries, which I edit.

Now that we are even, I'd like to note that in one of Don's *"San Engr. News,"* he pointed out that every minute, 94,248,000 gallons of water go over Niagara Falls. Well, according to I. O. (Bert) Lacy, Supt. of Sewage at Lockpart, at least one man predicted that such would not be so. It was during the construction of the Erie Canal.

* * *

"Bert" sent me a copy of a letter to the editor of the *Niagara Sentinel* of Lewiston, N. Y. The letter signed, "Ditcher" and addressed to the Canal Commissioners was dated Oct. 11, 1882 read, in part as follows:

"It is supposed by all true believers of the superlative science of Geology, that the waters of the Falls of Niagara once poured themselves over the mountain ridge at Lewiston, 7 miles below their present situation, as from appearances the fact is fully

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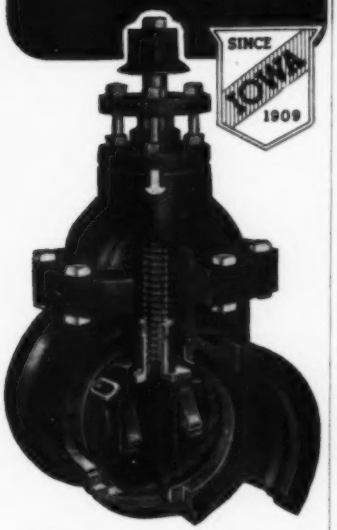

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and clearly substantiated. The immense body of liquid element, rushing with so much violence, has in course of time, gradually worn away the soft rock over which it passed, and every year its situation (the falls) is altered, and will continue to altar if any faith can be placed in a proverb spoken by mouth of the wisest of children of men: viz. 'continual dropping weareth away stones.'

"Yes, without doubt the falls are rapidly retreating toward Lake Erie, and will continue to do so until in progress of time, their situation will be at the outlet of Lake Superior. . . . (Yes, he said Superior) . . . what then is to become of the torrent that is to pour upon the mill wheels of Lockport, fertilize its soil, and convert, it from a thriving village to a splendid metropolis? What then will become of the western section of the Great Canal (Erie Canal) which is constructing with so much labor and expense through the mountain ridge for the purpose of meeting the waters of Lake Erie at Buffalo.

"A century or two hence, perhaps in less time, the waters of Lake Erie (if indeed there be any lake where its waters now roll) will be on a level with the waters of Lake Ontario, and how, in this case, will this vast and important section of the canal be supplied with the element which it is designed to receive, and on which it depends for its existence? . .

"Thus the care, labor and money expending between the village of Lockport and Buffalo is entirely thrown away. Why then, oh! Commissioners, will you persist in carrying out this section of your work with so much ardor and trouble in the direction intended? The eyes of your sister states, New York, are fixed on you waiting the result of this great work, and when the event I have predicted shall come to pass how will those that now envy the magnitude of your views triumph, and the incredulous Anti-Canalists turn your enterprising spirit to scorn. . . ."

Yep, people got "het" up about things seventy years ago.—Now, Mr. "Ditcher" is dead and gone, the Canal continues to operate sucessfully, and of course not a century has passed, certainly not two, but with the work of Canadian and American Engineers, the progression of the Falls upstream is now very slow. Just goes to show you that time rather ignores the railings of we mere mortals—so—if I hurt any feelings in my comments a couple of items above, remember, by the time the Niagara Falls has

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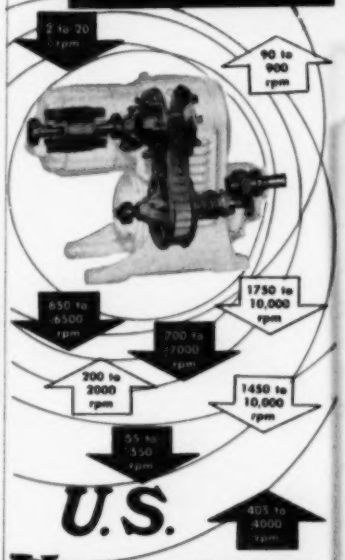

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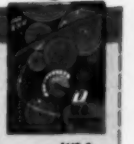

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reached the mouth of Lake Superior, our personal opinions will be lost in the dust of countless decades.

* * *

I haven't the space this month to cover the convention stories of the NEWWA, or the Federation but come next month, I'll get back into the groove again. For the present, just don't forget the 25th Anniversary Meeting of the Federation at the Hotel Statler in New York City, Oct. 5-9. Will you help make it a big one?

V.T.Y.—Doc.

District of Columbia To Start Fluoridation

Water officials have announced fluoridation of the District of Columbia water supply will be started by mid-April. The Washington Suburban Sanitary Commission began fluoridation on January 1, 1952, for the supplies of Prince Georges and Montgomery Counties in Maryland.

Edwin A. Schmitt, chief of the water supply division of the Washington Aqueduct, says a contract has been signed to buy 200 tons of sodium silicofluoride, enough to apply the treatment through the fiscal year ending June 30. He stated delivery of fluoride feeding equipment is scheduled before April 1st, and that the program can be undertaken promptly.

The District is purchasing silicofluoride at $.075 per pound, and estimates that 500 tons will be required for a full year's supply. At the present price, the chemical cost will be $75,000, according to this estimate.

Council Bars Fluoridation— Detroit Citizens May Ballot

According to the Detroit, Mich., *Free Press*, steps are being taken to force the question of fluoridation of the city's water supply by putting it on the ballot for a popular vote. The Detroit Common Council has recently voted against undertaking fluoridation.

A group of Detroit dentists is reported to be backing the move to have the question put on the ballot for the next primary election, September 1952. Nearly 1500 valid initiatory signatures on petitions will be required to force the question.

Value of Fluorides Seems to Extend to Adults Also

Much has been published to reveal the benefits to children served water containing fluorides. The question has been raised in many quarters—"Does this benefit in childhood extend into adulthood?"

To answer this question surveys have been conducted which appear to reveal that the adult population also benefits, as indicated by records of the condition of adult teeth. The surveys were made by the U. S. Public Health Service in Boulder and Colorado Springs, Colo. The water supply of Boulder contains little or no fluorides; that of Colorado Springs has contained 2.5 parts of fluoride and most of the adults of this city have been drinking this same water since early childhood or infancy.

The record reveals that the adult group between 20 and 25 years of age was the most benefited. In Boulder this age group contained *no* person without a history of decayed teeth. In Colorado Springs 26.4% of the persons between 20 and 25 years of

(*Continued on page* 107A)

when water pressure means the most

City officials, municipal and industrial engineers shoulder a tremendous responsibility in the maintenance of water pipe lines. They know that pressure failure due to leakage or tuberculation can often have disastrous results.

Today, the neglect of water lines—however old—is uneconomic. The Centriline process of centrifugally applying cement-mortar lining to pipe lines *in place* virtually makes new pipes out of old at a fraction of the cost. Centrilining, not only prevents tuberculation and leakage, but totally eliminates corrosion to the inner walls. Pumping costs are lower, maintenance reduced and the saving over new pipe lines often amounts to many thousands of dollars.

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WATER & SEWAGE WORKS

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(Continued from page 106A)

age had *no* history of decayed teeth. Above 25 years of age the record reveals a diminishing percent in each age group without history of decayed teeth.

The most significant observation, perhaps, is that in all age groups between 20 and 44 years the record of decayed, filled or pulled teeth revealed 60% fewer such teeth for the adults of Colorado Springs where the water contains 2.5 parts of fluoride. Possibly the strongest evidence is found in the Colorado Springs 20-25 year group in which 26.4% of the individuals had experienced *no* tooth decay in contrast to *no* person so fortunate in the same age group in Boulder. All in the Colorado Springs age group through 25 years had been drinking water containing 2.5 parts of fluoride since infancy.

Excerpts from Purdue's Sanitary Engineering News*

New York's Class F streams are assigned to be used as sewers. Let's hope that we never dedicate any of Indiana's streams for such a purpose.

There's nothing like mastering one obstacle to help you master those ahead.

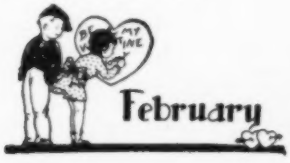
Fluorine to be used by the body must appear in water as a salt and not as the free element fluorine. A fluoride may be added to water directly as sodium fluoride, sodium silico-fluoride, or as an acid such as hydrofluosilicic acid.

At New York the grounds of new treatment plants are usually covered with 3" of sludge over 3" of sand.

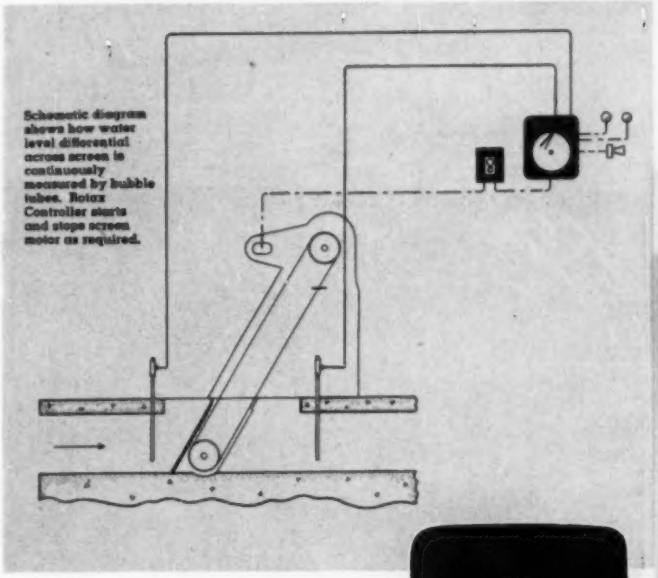
A flowing well on the shores of Lake Amatitlan in Guatemala is discharging 3,000 g.p.m. of boiling water and sending it to a height of 50 feet above the ground surface.

It is reported that sodium silicate is more effective than other agents in delaying the settlement of iron from a chlorinated well water supply.

*Edited by Prof. Don E. Bloodgood.



Make Bar Screens Practically "Plug-Proof"



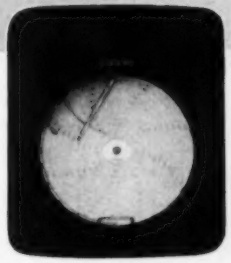
Schematic diagram shows how water level differential across screen is continuously measured by bubble tubes. Rotax Controller starts and stops screen motor as required.

with Foxboro liquid level type screen control

Make sure your channel can't go "dry" when excessive refuse suddenly piles up on the bar screen!

The Foxboro Bar Screen Control System automatically starts the rake motor whenever refuse accumulation causes the water level differential between opposite sides of the screen to exceed a certain preset value. Quickly, it purges the screen of refuse and restores intake level to normal—or sounds an alarm indicating that the cleaning mechanism is unable to cope with the difficulty. What's more, this action takes place only when the screen actually becomes clogged . . . no waste of power or unnecessary wear on mechanism through needless periodic operation.

Easy to install and inexpensive to operate, the Foxboro Bar Screen Control System pays big dividends in better intake operation, less maintenance and greater peace of mind. Write for complete information. **The Foxboro Company, 2282 Neponset Ave., Foxboro, Mass., U.S.A.**



ROTAX Liquid Level Controller, the heart of the system. Translates level differential into operation of motors. In addition, it can operate warning horn or light in case of unusually severe fouling. Circular or rectangular case models.

FOXBORO INSTRUMENTATION
INDICATING • RECORDING
CONTROLLING
REG. U.S. PAT. OFF.

MEETINGS SCHEDULED

(Continued from page 101A)

Oct. 14-17—Atlantic City, N.J. *(Chalfonte Hotel)*
PENNSYLVANIA WATER WORKS ASSOCIATION. Sec'y, W. A. Kufs, 510 Telegraph Bldg., Harrisburg, Pa.

Oct. 20-24—Cleveland, Ohio
AMERICAN PUBLIC HEALTH ASSOCIATION. Sec'y, Mrs. W. R. Walsh, A.P.H.A., 1790 Broadway, New York, N.Y.

Oct. 23-25—Atlantic City, N.J. *(Hotel Madison)*
NEW JERSEY SECTION A.W.W.A. Sec'y, C. B. Tygert, Box 178, Newark 1, N.J.

Oct. 23-25—Mason City, Iowa *(Hanford Hotel)*
IOWA SECTION A.W.W.A. Sec'y, H. V. Pedersen, Municipal Bldg., Marshalltown, Iowa.

Oct. 28-31—Pasadena, Calif. *(Huntington Hotel)*
CALIFORNIA SECTION A.W.W.A. Acting Sec'y, Lee Streicher, Metropolitan Water District, 545 Cloverleaf Way, Monrovia, Calif.

Oct. 29-31—Washington, D.C. *(Wardman Park Hotel)*
CHESAPEAKE SECTION A. W. W. A. Sec'y, Carl L. Lauter, 6955 33rd St., Washington, D.C.

Nov. 5-7—Old Point Comfort, Va. *(Chamberlin Hotel)*
VIRGINIA SECTION A.W.W.A. Sec'y, W. H. Shewbridge, Regional Engr., 708 State Office Bldg., Richmond, Va.

CUTTING THE MAIN. Illustration shows cutting dome, temporary shut-off valve and permanent valve body in place.

Section removed from main

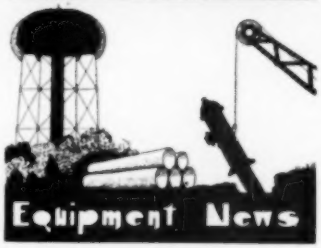
At a large Eastern steel mill uninterrupted production depended upon a thirty year old, 48" cast iron main, carrying sea water used for cooling the furnace jackets. The main was in poor condition — badly corroded and electrolytically pitted.

In order to provide an emergency by-pass in the event of line failure, a gate valve was required. Since the mill could not risk even a momentary shut down, Smith was asked to insert the valve under pressure. Although of unprecedented size, the insertion was completed in four days without interruption of service or reduction in pressure.

*First 48" insertion ever made under pressure. One month later a second 48" gate valve was inserted by Smith for the Water Bureau, Philadelphia, Pa.

THE A. P. SMITH MFG. CO.
ESTABLISHED 1896
EAST ORANGE, NEW JERSEY

Manufacturers & Equipment News



Motor Control Center

201

General Electric, Schenectady, N.Y., has announced a completely new motor control center for use wherever two or more a-c motors (up to 200 hp, 600 volts) are to be controlled from a central location.

The new center, pre-engineered, factory wired and assembled, provides a simplified method of installing and servicing in a central location a-c combination motor starters in NEMA sizes 1 through 5, as well as lighting panels and associated equipment for a group of motors.

The center is designed to withstand short circuit stresses up to 25,000 amperes, substantiated by certified laboratory tests. Its sections, each measuring 20-in. deep, 20-in. wide, and 90-in. high, join together to form a strong, free-standing, completely dead-front, NEMA 1 enclosed, cotrol assembly.

J. W. Northcutt

C. K. Madison

Rockwell Reorganizes Sales Department

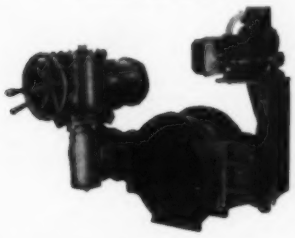
Rockwell Manufacturing Company, Pittsburgh, Pa., has announced plans for the country-wide reorganization of the Company's sales department. Five regional managers have been appointed to service the entire United States.

The Eastern Region will be under the direction of M. J. Harper with headquarters in New York City. The Central Region will be supervised by P. C. Kreuch with headquarters in Pittsburgh. The Southern Region will be headed by J. W. Northcutt

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

with offices in Atlanta, Ga. The Mid-Western Region will be under the jurisdiction of C. K. Madison with offices in Houston, Texas. The Western Region will be managed by H. Boezinger with offices in Los Angeles, California.

Rockwell will continue to maintain district offices in the major cities of the country as they have in the past.



Dual Purpose Valve

202

R-S Products Corporation, Philadelphia, Pa., has developed a 125-pound cast iron valve which consists of a 12 inch beveled vane which seats against the body side wall with a 4 inch vane mounted in the center of the larger vane. This makes it really a valve within a valve.

It is usually employed in a turbine bypass line for controlling the required quantity of water when the turbine is not in use or when it is operating at a reduced capacity. Valve is equipped with 18-8 shafts, bronze bushings, and two lubricated stuffing boxes with two outboard bearings. Both vanes are motor operated.

Designed for either a high pressure drop and small volume or a low pressure drop and large volume, this type of valve is frequently furnished with a small free revolving vane.

The valves are available in various combinations of sizes and for elevated or sub-zero temperatures with either manual or automatic control.

Honeywell Opens District Office

Minneapolis-Honeywell Regulator Company, Philadelphia, Pa., has announced the opening of a new district office at Harrisburg, Pa.

The new office, located in the Kline Village development, was made necessary, Honeywell officials said, by an increasing demand in the Harrisburg area for process measuring and controlling instruments and for heating and commercial controls.

William J. Brosch and Jack Caylor will handle sales for the company's

SARAN LINED steel pipe

WHAT part of industry's six billion dollar corrosion bill are you paying? Any amount is too much and can be cut considerably through the installation of saran lined steel pipe. You will find, as have many of the country's leading manufacturers, that saran lined steel pipe means dependable, long term operation. In addition to the excellent corrosion resistance of this remarkable pipe—you have the plus values of rigidity, pressure strength and ease of installation, requiring NO special tools. These advantages are all important to you in the reduction of shut-down time, lost production and equipment replacement.

Saran lined steel pipe is manufactured by The Dow Chemical Company. For full information, mail this coupon today to The Saran Lined Pipe Company.

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SARAN LINED PIPE

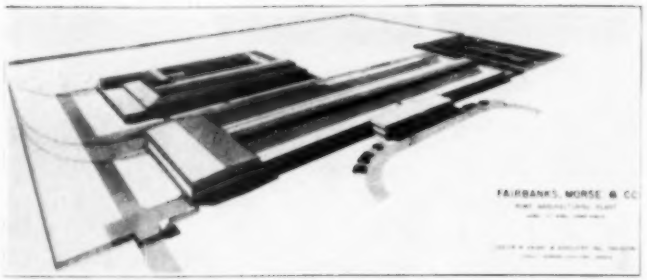
DOW

product

Brown Instruments division. John Hopkins will handle commercial, and Donald Schmick heating controls divisions sales.

Fairbanks, Morse Awards Pump Plant Contract

Fairbanks, Morse & Co., Chicago, Ill., has awarded a contract to the S. Patti Construction Co., of Kansas City, Missouri, for the yard work for its new pump plant in Kansas City, Kansas. The contract is on a cost plus basis and will be for the sewers, roads and other ground detail.



Contracts as yet have not been let for the actual construction of the plant which is scheduled to begin next spring. The new plant will have a machine shop containing 190,000 square feet of floor space, a foundry with 150,000 square feet, and an office building with 20,000 square feet.

Chlorine is shipped to you in steel containers . . . cylinders, drums, tanks . . . yet there's no corrosion hazard because this chlorine is moisture-free and inert.

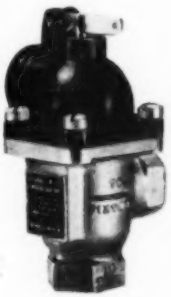
How does your chlorinating equipment handle chlorine — *wet or dry?*

BUILDERS Visible Flow CHLORINIZERS meter and control chlorine gas in the dry, non-corrosive state. The dry gas has passed through *all* vital control and metering parts in Builders Chlorinizers *before* it comes in contact with water in the bell jar. Further protection against corrosion of vital parts is afforded by a moisture trap which isolates the chlorine control valve and the Sightflo indicator from the slightest trace of moisture.

If you make your way of feeding chlorine gas the *dry way* — with Builders Chlorinizers — you can count on years of dependable, safe, accurate chlorination at lowest overall cost because you have the chlorinating equipment that's easiest to maintain today, next year, or a decade from now. Think about this when you specify chlorinating equipment.

For Bulletins 840-F2A, 840-F1, and 840-G27, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 350 Harris Ave., Providence 1, Rhode Island.

BIF INDUSTRIES — BUILDERS PROVIDENCE Instruments — BUILDERS



No. 201

Temperature Relief Valve Prevents Hot Water Back-Flow

203

McDonnell & Miller, Inc., Chicago, Ill., has developed a new temperature relief valve, of the automatic reseating type, designed to prevent excessive water temperatures in hot water tanks and heaters.

Identified as the McDonnell No. 201, it has been tested, rated and listed by the American Gas Association for heat input up to 1,200,000 Btu./hr.

Operating heart of the No. 201 is the well-known Vernatherm thermostatic element, specially adapted for this service. The Vernatherm is a hermetically sealed element, containing a chemical mixture of organic and metallic particles, which expand and contract in response to variations in temperature. The internal forces created by these temperature changes serve to open and close the valve orifice. The valve starts to open at 188°F., and reaches its maximum capacity at 208°F.

The Vernatherm element reseats itself automatically, and closes off quickly at just a few degrees below the opening temperature to avoid hot

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water waste; exhaustive tests indicate the thermostatic element will close the valve drip tight by the time temperature drops to 183°F.

John P. Harris Opens Chemical Sales Firm

John P. Harris, who recently ended a long career with the Industrial Chemical Sales Division of West Virginia Pulp and Paper Company, when he reached retirement age, now is operating his own chemical sales business at 1791 Howard St., Chicago, Ill.

The firm handles both powdered and granular activated carbons, precipitated calcium carbonates and filtration materials.

Mr. Harris' wife, Mildred James Harris, is vice-president of the new corporation, and his son, James T. Harris, is secretary.

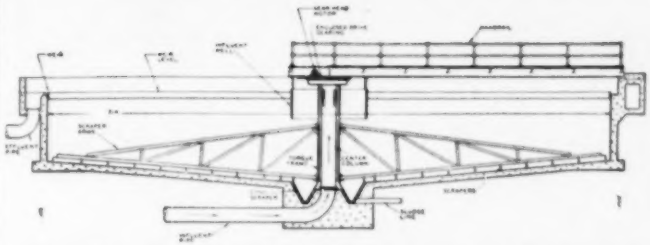
Sand Filter-Clarifiers

204

Hardinge Company, Incorporated, York, Penna., has developed a Hardinge Sand Filter-Clarifier that is particularly applicable to clarification operations, where perfect clarification, or a crystal-clear liquid product, is desired.

The Filter-Clarifier is employed for the clarification of the over-flows from settling tanks on problems where perfect clarification cannot be economically accomplished by sedimentation. In other cases it is used where the suspended solids to be removed have an

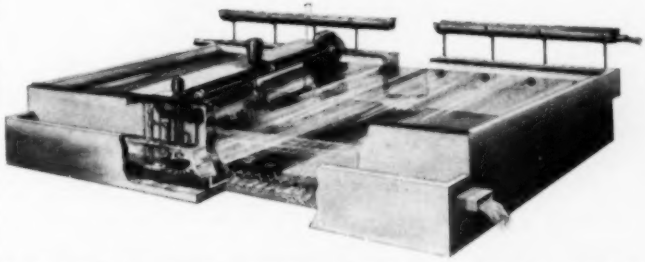
• CIRCULAR CLARIFIERS—THICKENERS



Hardinge Circular Clarifiers for water treatment are available in sizes up to 200' diameter either center-column or beam-supported for steel, concrete, wood or tile tanks. Bulletin 35-C-15.

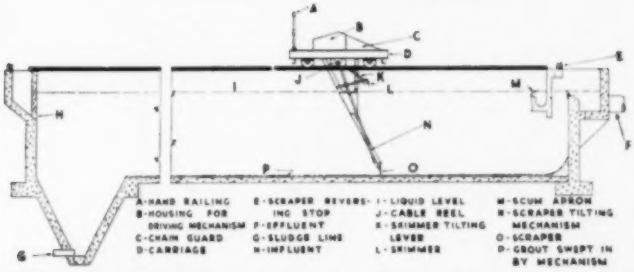
Hardinge Thickeners for removal of fine suspended solids from supply water, and sewage, are similar to the Clarifiers but of heavier construction. "Auto-Raise" mechanism prevents scraper breakage. Bulletin 31-D-15.

• AUTOMATIC BACKWASH RAPID SAND FILTERS



For high removal of non-settling or slow-settling suspended matter. Self-cleaning sand bed. No shutdown necessary for backwashing. Bulletin 46-15.

• RECTANGULAR CLARIFIERS



Especially suited for limited spaces or where sludge delivery is desired at one end of the tank. Highly successful as an oil-water separator. Bulletin 35-C-15.

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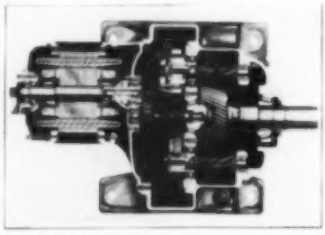
apparent specific gravity equal to that of the suspending liquid medium. According to the company, it offers advantages over the ordinary sand filter in that a back-wash arrangement, with the consequent wasting of the washing liquids, is eliminated. This unit uses, instead of a backwash, a spiral scraper that takes a cut off the sand bed when the filter rate decreases.

The capacities of the filters vary on different materials from 1/30 to 1 gal. per sq. ft. filter surface per minute. An average figure made up from data on 10 typical installations shows 1/3 gal. per sq. ft. per min. capacity and an average suspended-matter content of the liquid before filtering of 0.1 per cent.

E. J. Morgan Joins Chicago Office of Zurn

J. A. Zurn Manufacturing Co., Erie, Pa., has announced that E. J. Morgan, well known in Illinois engineering circles, is now associated with the Industrial Division of the Chicago office of the company.

With more than 40 years of varied experience as a mechanical engineer, 30 years of which he was associated with De Laval, engaged in the sales and engineering aspects of heavy equipment such as turbines, pumps, and condensers, and with an interlude as purchasing agent, Mr. Morgan is exceptionally fitted to be of assistance to all who have fluid handling problems.



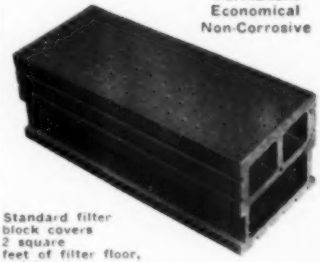
Triple Reduction Geared Motor

205

U. S. Electrical Motors, Inc., Los Angeles, Calif., through triple reduction gearing in the new Type GM

THE LEOPOLD GLAZED FIRE CLAY TILE FILTER BOTTOM

Permanent
Economical
Non-Corrosive



Standard filter block covers 2 square feet of filter floor, weighs about 50 pounds per square foot.

Proved and approved in over 200 purification plants!

The Leopold Duplex Filter Bottom is made up of individual blocks which are firmly joined together to provide a strong bed that is not disturbed by wash water. With this efficient, enduring system, you're assured an equal collection of filtered water with extremely low loss of head. There is no possible corrosion or tuberculation anywhere in the filter bottom. Made of de-aired fire clay—vitrified and salt glazed, the highly efficient Leopold Filter Bottom requires only shallow depth of small sized filter gravel and is acid and alkali resistant. Adaptable to any rectangular filter unit, it won't absorb any detrimental amount of water.

★

Complete Water Purification and Sewage Plant Equipment!

- *Dry Chemical Feeders*—made in several sizes and capacities adjustable to meet a wide variety of operating requirements.
- *Filter Operating Tables*—master units for centralized control of hydraulic valves, furnished in any size, combination or style desired.

Complete details furnished on request

F. B. LEOPOLD CO. INC.
2413 W. Carson St., Pittsburgh 4, Pa.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

Syncrogear motor, now offer a high torque, low-speed motor capable of ratios up to 175:1. By the use of two secondary pinions driving the output gear, the effective torque rating is doubled. The load is distributed equally between the two pinions by a splined herringbone pinion. Consisting of an efficient, high-speed motor with torque multiplying, built-in gearing, the Type GM Syncrogear motor greatly reduces the amount of space necessary to house this type drive. They are available in 1 to 10 hp, with speed ranges of 5 to 25 r.p.m.

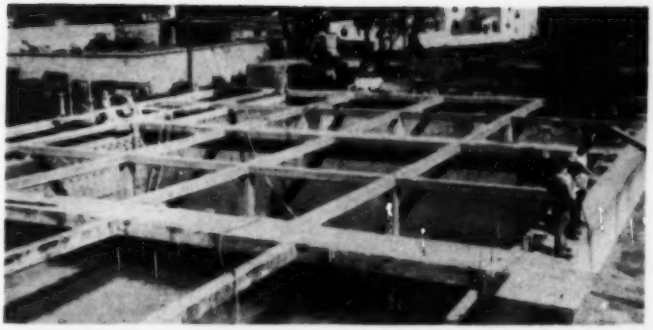
Yardley Plastic Pipe and Fittings

206

Improved plastic pipe and fittings manufactured by the Yardley Plastics Co., 142 Parsons Ave., Columbus, Ohio, is pictured in accompanying photo. Yardley's production of this pipe is expected to increase 40% with the opening of the firm's new Factory No. 2, Fred B. Hill, President, announced.

In the picture, reading down from top, are: (1) Yardley's M-6 rigid plastic pipe with cement-type sleeve coupling (no threads); (2) the M-2 flexible plastic pipe which is connected with insert threaded adaptors; (3) M-6-T/C plastic pipe (threaded and coupled at factory)—threaded adaptors furnished with all standard lengths; (4) M-1 plastic pipe, with hard insert adaptor attached by clamp.

This plastic pipe is offered for about every type of cold water installation, irrigation system, jet well settings, drainage and sewage disposal lines and many other practical uses. The manufacturer claims that



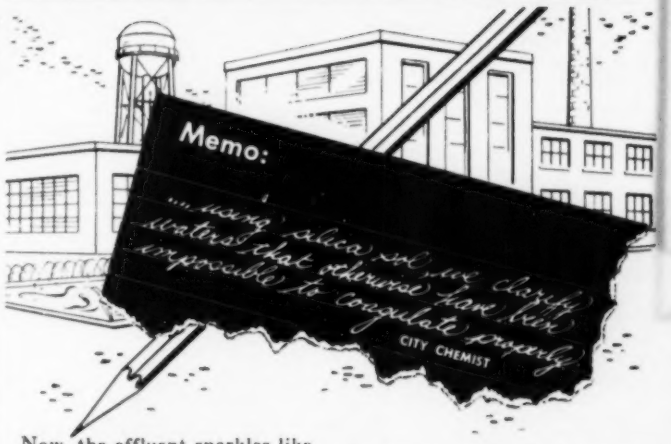
"GUNITE" LINING RESTORES RESERVOIR

When the old, open Ballou Park Reservoir at Danville, Va., was improved and covered in 1948, excessive leakage of the old brick lining was stopped with reinforced "GUNITE." The photo shows details of the process. After concrete columns to support the roof were placed, wire mesh reinforcing was laid and the entire reservoir was "GUNITED."

Note that the reinforcing and "GUNITE" were carried over the column footings and up the columns approximately three feet to prevent leaking at those points.

The use of "GUNITE" for repair and construction of reservoirs, bridges, buildings, etc., is illustrated and described in Bulletin C2400. We shall gladly send a copy at your request. On your letterhead, please.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA. U.S.A.
MANUFACTURERS OF THE CEMENT GUN



Now, the effluent sparkles like spring water with N-Sol activated silica. This coagulant aid increases size, strength and density of floc. All types of water (flood, well, surface waters, highly colored waters) are treated regularly by the N-Sol Processes.

N-Sol Activated Silica is easy to prepare in your plant by reacting N. Silicate of Soda with ammonium sulphate, chlorine, alum or sodium bicarbonate. Send for bulletin #52-19.

PQ N-Sol® Processes
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pH, Color, Manganese, Total Iron, Ammonia, Chlorine, Nitrite N, Nitrate N, Fluoride, Copper . . . all can be easily and quickly determined when you have a complete Taylor Water Analyzer Kit available in your plant. Each determination is made with separate slide. There's no handling of fragile, single standards since each slide houses a complete series of color standards. And . . . all Taylor Liquid Color Standards carry an *unlimited guarantee against fading.*

Truly, the complete kit gives you a "laboratory-in-a-carrying-case", for it contains a base, slides, all reagents and accessories. It is light weight and easy to carry, thus available for immediate use wherever you are. SEE YOUR DEALER TODAY.

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the use of plastic pipe and fittings save up to 60% in installation costs. It is light, easy to handle, and can be laid up quickly. It is made of non-critical materials, and will not rot, rust or corrode. Yardley pipe and fittings come in all standard sizes from ½-inch to 6-inch.

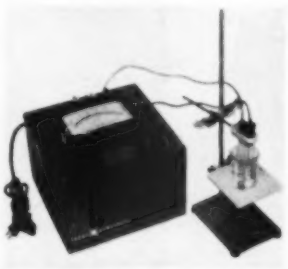
Industrial Chemical Sales Appoints New Chicago Manager

Industrial Chemical Sales Division of West Virginia Pulp and Paper Company has announced the appointment of John F. Zieserl as Chicago district manager.

Mr. Zieserl succeeds John P. Harris, manager of the company's midwestern sales office since 1935, who has reached retirement age.

In his new post Mr. Zieserl will direct the sales of the company's chemical products in 16 midwestern states.

Mr. Zieserl has been associated with the chemical company since 1924 when he started as a junior clerk. He has served in the company's main office in New York throughout his business career and was administrative assistant to the vice-president in charge of chemical sales when he received the new appointment.



pH Indicator and Vacuum Tube Voltmeter

207

Leeds & Northrup, Philadelphia, Pa., has developed a new line-operated pH Indicator and Vacuum Tube Voltmeter that is unaffected by normal fluctuations in line voltage or by zero drift of the amplifier. A con-

Every bag of
BOND-O Homogenized
is a bag of perfect jointing compound

BOND-O's exclusive machine blending process brings you the *one* flawless self-caulking jointing compound. The finest basic materials obtainable are so thoroughly blended by the BOND-O process—that you are assured of absolute uniformity of performance from every bag you buy.

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INSURE YOUR FILTER
AT NO COST
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FILTER SAND and GRAVEL
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Close attention to detail by experienced men and new modern equipment insure both the quality and prompt shipment of all orders. Our method of shipping in bulk prevents mixing of sizes in transit.

SHIPMENT IN BAGS WHEN PREFERRED
Try us on your next order.

NORTHERN GRAVEL COMPANY
P. O. Box No. 307, Muscatine, Iowa

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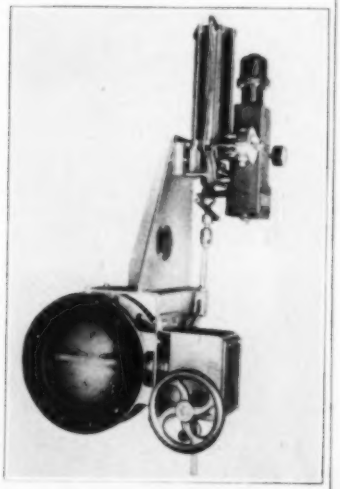
verter-type instrument, its circuit employs d.c. to a.c. conversion a.c. amplification, and conversion back to d.c. for voltage feedback. Conversion stabilizes zero; feedback stabilizes gain.

Used as a pH Indicator, the instrument reads directly in pH; makes glass electrode measurements to within ± 0.02 pH on grounded or ungrounded solutions. Continuous pH 0 to 14 scale eliminates range-changing. For manual lab use, temperature compensator is graduated from 0 to 100 c in 2 degree steps. If the instrument is used as a continuous indicator on industrial process pH, automatic temperature compensation can be provided.

As a Vacuum Tube Voltmeter, the new indicator can be used with any high or low impedance electrode system which develops potentials within range of the instrument.



High Pressure, Rubber-Lined Butterfly Valves

208

W. S. Rockwell Company, Fairfield, Conn., has developed a line of rubber-lined butterfly valves for operation and tight shut-off at high pressures. These valves range in pipe size from 4 to 36 inches and larger.

According to the company, the purpose of such rubber liners is to insure tight closure, particularly at higher temperatures. The valve, body and blade are generally of cast iron or cast steel with a steel blade. Where corrosive conditions are prevalent, the blade may be rubber covered or made of stainless steel.

For automatic operation it is equipped with an air cylinder con-

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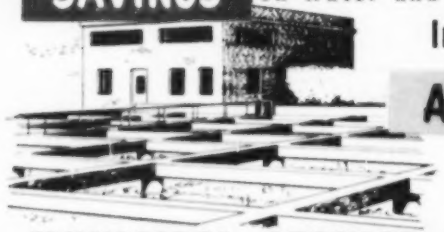

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troller and with remote manual control, as well as a clutch and hand wheel control at the valve, in case of automatic controller failure.

Pennsalt Completes New Sales Division Reorganization

Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., has completed steps in a new organization of its Sales Division.

Mr. William P. Drake, Vice President in Charge of Sales, stated that the new organization, toward which the company has been moving for the past two years, is designed to consolidate sales administration while retaining specialization essential to the company's diversified interest, and at the same time provide more emphasis on planning for current and future sales activities.

The line organization of the Sales Division is headed by Russell S. Roeller as General Sales Manager. Reporting to him are Albert H. Clem as Field Sales Manager, Edwin S. Garverich as Manager of Technical Service, and the eight department sales managers.

Mr. Clem formerly was Sales Manager of the Industrial Chemicals Department. He will be responsible for all district sales offices and their managers will report to him. Mr. Garverich formerly was Manager of Technical Service on Specialties.

Anti-Corrosion Electrical Pipe Tape

209

Minnesota Mining and Manufacturing Co., St. Paul 6, Minn., has announced a new heavy-duty plastic electrical tape designed for applications where more-than-average mechanical strength is needed.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

Designated "Scotch" brand electrical tape No. 21, it is recommended for anti-corrosion protection for pipes, cables and equipment laid underground where resistance to cuts and abrasion by rocks during backfill is important.

The tape has a black, vinyl plastic backing that is 20 mils thick—more than twice the thickness of previous tapes of its type. It has a dielectric strength of 22,500 volts, an insulation resistance of 200,000 megohms, and an electrolytic corrosion factor of 1.0.

The tape is available in 36-yard rolls ranging in widths from ¼-inch to 16 inches.

C. I. Soil Pipe Institute Appoints Robertson

The Cast Iron Soil Pipe Institute, with executive offices in the Heurich Building, Washington, D. C. has announced the appointment of Homer E. Robertson as executive vice president.

Mr. Robertson, prior to his appointment, was vice president in charge of sales of the Somerville Iron Works, Newcastle, Pa., manufacturers of cast-iron pipe and fittings.

Mr. Robertson has played a prominent part in the organization of the Institute and as executive vice president plans to expand the services which the Institute offers.

Literature & Catalogs

New Booklet On Cement Sewers

210

Portland Cement Association, Chicago, Ill., has just published a new 48-page booklet entitled **"Concrete Sewers."**

The booklet, designed primarily as a reference book for sanitary engineers, contains a number of tables and charts packed with valuable information on the design and construction of concrete sewer systems. This material includes the latest available research data covering loads on sewer conduits.

Among the topic headings discussed are the hydraulics and construction of sewers, types and design of sewer systems, and loads on sewers and sewer appurtenances.

The final chapter covers maintenance and repair of sewer lines and includes information on safety precautions in sewer operations.

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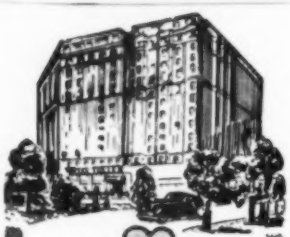

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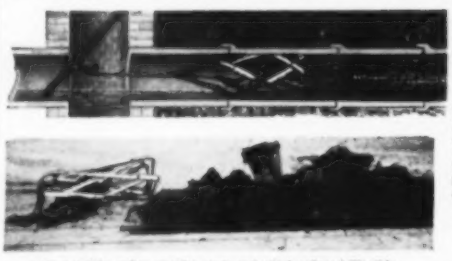

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Steel Uses For Public Works

211

Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa., has just published a handsomely illustrated 32-page brochure that makes a complete presentation of the **Pittsburgh-Des Moines Steel Company.** The brochure shows and describes the many steel plate and structural products made by the company for industrial and municipal use, as well as public works.

Beginning with a historical note on the development of the company from its founding in 1893, the publication shows production facilities for P-DM's three plants, and portrays extensively the broad work of the firm.

Representative elevated steel tanks are shown from among the thousands built by the company since its pioneer days in the field. Also illustrated and described are a variety of steel reservoirs and standpipes, pressure and vacuum spheres, gasholder, non-presure liquid storage tanks, and bins for the storage of dry, free-flowing materials.

Dorr Detritor

212

Dorr Company, Stamford, Conn., has just published a new, 24-page, two-color bulletin which describes the **Dorr Detritor** in detail covering the several different types available, with drawings, sizes, capacities and operating descriptions.

The bulletin states that the Detritor is designed on an area basis and removes over 95% of all grit larger than a definite size (usually plus 65 mesh), from the maximum flow to the plant. It produces a washed grit, drained of its free water, and containing not more than 3% by weight of putrescible organic matter. Detritors will operate under widely varying flows without requiring adjustments.

The last eight pages of the bulletin are devoted to a discussion of grit chamber design principles. This sec-

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tion proves both theoretically and by grit analysis from various installations that the capacity of a grit chamber is in direct proportion to the area regardless of the relation of width, depth and velocity. The inadequacy of the "1 ft./sec.-60 sec. detention" rule of thumb formula is clearly demonstrated.

Photographs of numerous installations as well as operating results from 32 Detritors in the field complete the bulletin.

Clay Liner Plates

213

Universal Sewer Pipe Corporation, Cleveland, Ohio, has just published a 6-page, 2-color brochure on **Universal Vitrified Clay Liner plates.**

The brochure discusses both flat plates and curved plates that are designed for lining either plain or reinforced concrete sewers, monolithic or pre-cast, storm and sanitary, and for sewerage disposal tanks. A table gives the size of sewer inches (from 12 to 102 inches), number of plates in circle and the radius in inches.

Photographs of the liner plates and actual installations along with diagrams for methods of laying the liner plates complete the brochure.

Non-Clogging Spray Nozzles

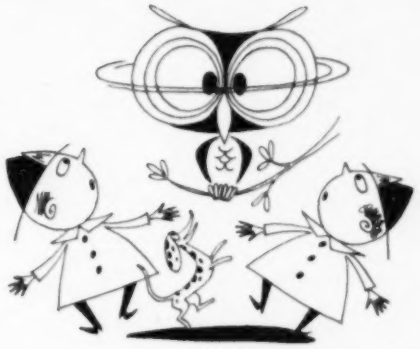
214

Link-Belt Company, Chicago, Ill., has just published a 4-page illustrated folder on **Non-Clogging Spray Nozzles.**

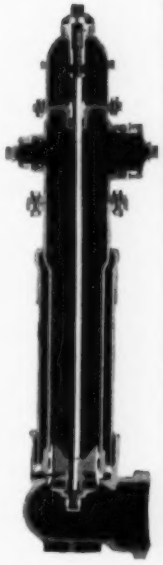
The folder describes the nozzles as being a scientifically shaped, curved bronze deflector having a smoothly-polished water contact surface and a sharp, true discharge edge—with a U-bolt and two hexagon nuts for holding the deflector in proper position on a pipe drilled with a plain hole at each desired spray location.

Folder shows installation pictures and how simply the nozzle can be applied. Tables give dimensions of nozzles for pipes of 1 to 3 inches diameter, and the capacity in gallons per minute through orifices of 5/32 to ½ inch diameter at pressures of 20 to 100 lbs. per square inch. Of particular interest to water works people is a photograph showing the use of the nozzles to propel scum to boxes located at one end of a water treatment settling tank.

Head turns all the way around



Nozzle direction may be changed easily and at any time by simply loosening the bolts in the swivel flange and turning the head . . . The number and size of nozzle outlets can be changed by replacing the head, and without shutting off the water.



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*Advertisers with * were represented in the April, 1951 Convention and Data Edition with Catalog specifications copy. Please refer to that issue for additional information on behalf of their products.

DORRCO DOINGS IN 1951

The year is ending with many changes of fundamental importance. England's new administration, though facing colossal problems, naturally makes believers in Free Enterprise more hopeful. Millions of us here today are thrilled by the hope that we can vote for a really great man, one like our first president, a great general, but above all an able and very wise patriot. No one believes that he would leave his present duties unless he felt that as president he could better serve his country and the world. It is inspiring to realize that he certainly can count on our strongest leaders to help build his team. A statement last year, that "America was in greater danger from within than without," is recalled when we think of the disclosure of lamentably lowered standards in many areas — a normal product, I would say, of stressing the doctrine that the State "owes" so much to all its citizens rather than that the citizen owes services to the State, if Democracy is to survive.

* * *

ABROAD — As here, our associates in Europe have had their greatest year. Among our projects starting this year were Colne Valley Sewage Plant, west of London, one of the largest sludge filtration and drying/incineration plaat in the world, and a large metallurgical plant for Mines de Bor in Yugoslavia.

RELIEVING THE SULPHUR SHORTAGE — Sulphuric acid manufacturers, sulphite pulp producers and other users of sulphur dioxide, faced with a world-wide shortage of elemental sulphur, have found the Dorrco FluoSolids System an economically feasible means of utilizing iron sulphides as an alternate source of SO_2 gas. Using pyrite running 48-50 percent sulphur and yielding a gas averaging 14-15 percent SO_2, or pyrrhotite with lower sulphur content and yielding a slightly weaker gas, FluoSolids has brought both installation and operating costs down to a reasonable level. Concurrently, development work continues in such fields as the calcination of water softening and chemical pulp mill lime sludges; the sulphating roasting of copper concentrates prior to leaching and direct electrolytic precipitation without smelting; and the roasting of zinc flotation concentrates for either electrolytic, retort or zinc fuming operations.

WORLD'S LARGEST TRICKLING FILTERS — The revitalized sewage treatment plant of the City of Baltimore, Maryland, now has 30 acres of trickling filters, served by 50 Dorrco Sewage Distributors, each 157 ft. 6 in. in diameter and designed to handle a total flow of 112 million gallons per day. Our association with this new "world's largest" dates from 1930 when we sold the city its first Dorr Clarifiers which are still in service.

ION-EXCHANGE — Two large Dorrco De-ionization Systems are scheduled to start up about the end of the year, purifying organic chemical solutions. Regardless of the nature of specific applications, we supply a complete, integrated service for handling all kinds of ion-exchange projects from the initial analysis of the problem to the starting up of the new installation.

DORRCO AERATOR-CLARIFIER — The new combination of two well-known principles has demonstrated its worth at Idabel, Oklahoma, and elsewhere. It fills a real need wherever it is desired to increase present removals of suspended solids and BOD'S — wherever odor control is a necessity — or where flocculation, with or without chemicals, is beneficial. It is readily adaptable both to primary and secondary treatment.

INDUSTRIAL WASTES — Greater attention is being given to solutions of this problem as business executives realize good public relations require that their plants create no offense and furnish effluents comparable with those of domestic treatment systems. Significantly, many large companies have appointed engineers with the sole responsibility of caring for their plant effluents.

DORRCO VACUATOR — This versatile sewage pre-treatment unit has this year convincingly demonstrated its worth and flexibility. One installation in Oklahoma removes scum, grit and some suspended solids from raw feed. Another, in California, pre-treats various trade wastes ahead of the municipal treatment plant. Still another, in Maryland, acts as a grease removal device.

CONSULTING ENGINEERING — During the year, Dorr-designed plants for producing the first triple superphosphate in England and magnesia from sea water in Norway were put into operation. Design jobs abroad have included a copper leaching installation in the Near East, a triple superphosphate plant for Greece and a phosphoric acid plant for Switzerland. Projects in this country covered such diversified operations as recovering blast furnace flue dust, remodeling a large gold cyanide plant, and producing SO_2 gas for the manufacture of sulphite pulp.

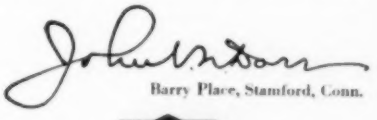
INDUSTRIAL WATER — The largest single equipment order booked in our history, will be used for industrial water purification in an amount approximating that daily used in New York City.

* * *

The high point for me in 1951 was a quick month spent in Europe revisiting most of our Associates. It was my first trip since '48 and I found great improvement both in physical conditions and in the mental attitude of all we met. Most interesting was a three-day session in honor of the completion of our new office building at Herengracht 478, Amsterdam. Three hundred years old and full of the dignity and real beauty of an older period, when merchants both worked and lived in the same home, it has been remodelled for our needs with loving care. Our group, foregathered there, represented twelve nations.

In Paris and Wiesbaden new and larger offices have been acquired and all our staff, crowded with work, bear testimony to their efficient organization and cooperation, and to the improved conditions in Europe.

It has been a busy year, with our organization keyed to meet the expansion inevitably brought about by world activity. We all join in sending New Year's Greetings to our Staff, Associates, and friends Worldwide, with the strong conviction that while "the impossible takes a little longer," it will be done, and that we can now see ahead, dimly perhaps, a picture of the World as we would wish it.



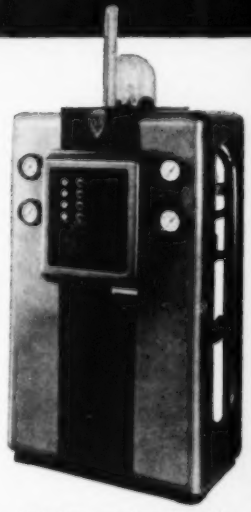
Barry Place, Stamford, Conn.

DORRCO

Expansion of an existing sewage plant, needed to meet the demands of increased population and industrial growth, may necessarily be delayed by current material shortages and building restrictions. In such a case, W&T Chlorinators can temporarily help carry the load by improving the efficiency of your present plant.

For example, overall plant efficiency can be increased when chlorine is applied ahead of and in the plant. Prechlorination ensures fresh sewage, giving better sedimentation. Plant chlorination aids grease removal, prevents filter ponding and minimizes sludge bulking. Disinfection of the effluent is ensured by post-chlorination—especially important where full treatment facilities are limited.

These are practical reasons why more and more communities are using W&T Chlorinators both to temporarily increase plant capacity and to ensure better operation of a future, expanded plant.



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